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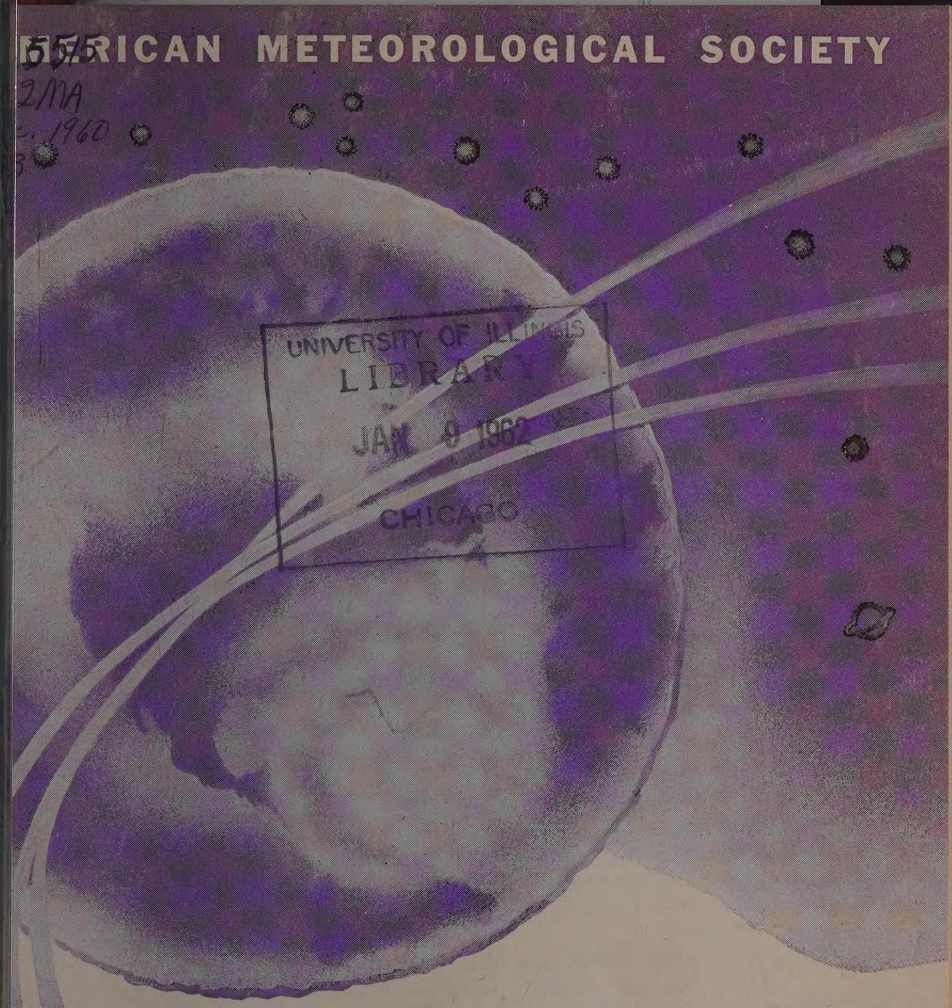

# Meteorological & Geoastrophysical ABSTRACTS

BIBLIOGRAPHY ON WEATHER MODIFICATION

Vol. 11 DECEMBER 1960 NO. 12
PART III

# METEOROLOGICAL AND GEOASTROPHYSICAL ABSTRACTS


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# METEOROLOGICAL AND GEOASTROPHYSICAL ABSTRACTS

MALCOLM RIGBY, Editor

Vol. 11 DECEMBER 1960 NO. 12
PART III

Sponsored by
NATIONAL SCIENCE FOUNDATION

## ANNOTATED BIBLIOGRAPHY ON WEATHER MODIFICATION

Compiled by: Otto Taborsky and Geza Thuronyi

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Published monthly at Prince and Lemon Streets, Lancaster, Pa., by the AMERICAN METEOROLOGICAL SOCIETY, 45 Beacon Street, Boston 8, Mass.

Printed and issued by: Lancaster Press, Inc

# FOREWORD

Meteorological and Geoastrophysical Abstracts is a monthly publication devoted to current literature in meteorology, geophysics and astrophysics.

Part I contains abstracts of current literature in the fields of meteorology, etc.

Part II of each issue comprises an annotated bibliography of important references on a special subject. Bibliographies published in the successive issues were:

Vol. I, 1950

1. Atmos. Pollution 2. Aerobiology 3. Cloud Physics 4. Hail
5. Tornadoes 6. Volcanic Dust 7. Climat. Changes 8. Thunderstorms
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3. *Limnology* 8. *Upper Atmos. Humidity* 11. *Jovian Planets and Moon*

Part III contains a listing of reviews, translations, reprints, and the contents of important publications. These are published in the earliest issue where space permits.

Part IV is made up of author, subject and geographical indexes.

## EXPLANATIONS

**Location of material:** For each entry, a symbol is given for at least one library where the material may be found. The Union List of Serials (Gregory) is the source of most of the symbols used. In some cases, where no symbol has been assigned to a library, one will be devised according to the principles of the Union List.

**Library symbols** used frequently may be found in the following list:

| | |
|---|---|
| **DA:** | U. S. Dept. of Agriculture Library, Washington, D. C. |
| **DBS:** | U. S. Bureau of Standards Library, Washington, D. C. |
| **DGS:** | U. S. Geological Survey Library, Washington, D. C. |
| **DLC:** | Library of Congress, Washington, D. C. |
| **DN-HO:** | U. S. Navy Hydrographic Office Library, Suitland, Md. |
| **DNLM:** | U. S. National Library of Medicine, Washington, D. C. |
| **DP:** | U. S. Patent Office Library, Washington, D. C. |
| **DWB:** | U. S. Weather Bureau Library, Washington, D. C. |

**Other symbols:**

| | |
|---|---|
| * | before an entry indicates a good data source. |
| † | before an entry indicates a good bibliography. |
| § | before an entry indicates a synoptic case history study accompanied by charts. |

**Geographic locations** are in the English form rather than the form used locally, for example, Moscow for Moskva.

**Titles of articles or monographs** are in the language of the original article unless otherwise stated. Slavic (Cyrillic) titles are transliterated into the Roman alphabet using a modification of the Library of Congress transliteration scheme.

**Abbreviations:**

*Titles of periodicals* are not abbreviated, as a rule.

The months of the year from March to July are not abbreviated. Other months are abbreviated as Jan., Feb., Aug., Sept., Oct., Nov., and Dec.

The word or abbreviation for Volume (Tom, Band, Jahrgang, Año, etc.), for Number (Heft, Fascicule, Vypusk, etc.) and for page or pages is omitted from most entries. Thus an entry will read as follows:

*Meteorologische Rundschau*, 2(5/6):146–151, May/June 1950.

This indicates that the article appeared in *Meteorologische Rundschau*, *Jahrgang* 2 (Vol. 2), *Heft* 5/6 (No. 5/6), *pages* 146–151, May/June 1950.

# ANNOTATED BIBLIOGRAPHY ON WEATHER MODIFICATION

*By:* Otto Taborsky *and* Geza Thuronyi

## INTRODUCTION

During the last decade weather control activities have been carried on throughout the world in laboratory and field experiments as well as practical operations aimed at increasing rainfall, preventing hail, dissipating fog, etc. The reports on the discussions of all these diversified activities have become so numerous that it was considered appropriate at this time to compile a bibliography on weather modification in order to facilitate evaluation of its present status. It was decided to repeat most of the material contained in two previous bibliographies (*Meteorological Abstracts and Bibliography*, Vol. 1, No. 3, March **1950** and Vol. 6, No. 10, Oct. **1955**) in order to bring together all pertinent literature in a single volume.

The subject matter included in this bibliography has been limited to practical aspects of weather modification, such as scientific experiments on artificial nucleation, commercial cloud seeding operations, methods of evaluation, etc. Some of the literature on accidental action on weather, e.g., effects of nuclear explosions, battles, etc., has been included. Papers dealing with the microphysics of clouds, condensation nuclei, thundercloud electrification and other natural processes in clouds, have been excluded and so have those on condensation trails caused by airplanes. Several bibliographies have been published on these subjects in earlier issues of *Meteorological Abstracts*, namely, two bibliographies on **Cloud Physics** (March 1950 and June 1955), two on **Atmospheric Nuclei** (Aug. and Sept. 1955), three on **Radar Meteorology** (Aug. 1951, July 1955 and Aug. 1958) and one on **Condensation Trails** (Sept. 1951). Additional material on these subjects may also be found in the **Current Abstracts** section in each issue of *Meteorological Abstracts*.

This bibliography contains 1016 references with abstracts or annotations arranged in chronological order by year of publication, and another 278 unannotated items, also arranged chronologically following the annotated group. An attempt has been made to assemble as much of the literature on weather modification as possible. Due to the considerable variety of sources in which such literature may be found (meteorological, hydrological, agricultural, general science and other journals, popular magazines, newspapers, conference papers, unpublished research reports, etc.) a collection of this nature cannot possibly be complete. For one thing, we did not attempt to include newspaper articles or to provide complete coverage of articles in popular magazines. Unpublished papers were used only if found in the collection of a library. Despite these necessary omissions it is felt, however, that reference will be found in this bibliography, in one form or another, to significant research or operational activities in weather modification reported in the international literature.

In order to facilitate the use of the somewhat voluminous material, several types of indexes have been prepared. Immediately following this Introduction there is an **Outline of Contents** in which subject references have been arranged under several major headings (GENERAL, HISTORY AND DEVELOPMENT, THEORIES, EQUIPMENT AND TECHNIQUES, CLOUD SEEDING AGENTS, PROJECTS AND OPERATIONS, EVALUATION METHODS, EFFECTS AND APPLICATIONS), in order to allow a systematic approach to the subjects covered. At the end of the bibliography there are alphabetical **Author** and **Subject** indexes and a systematic **Index of Geographical Locations.**

This bibliography has been prepared and is being published for and with support from the National Science Foundation. Credit should be given to DR. EARL DROESSLER and FRED WHITE, of that organization, for their interest and guidance.

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(*See also* alphabetical author and subject indexes, and an index of geographic locations in the back of this issue)

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## 1839–1857

**11M–1** 551.509.617

Espy, James Pollard [**Artificial rains**], *The National Gazette and Literary Register*, Philadelphia, 19(5798), Title page, April 5, **1839.** Reprinted in his **Philosophy of Storms.** Boston, **1841.** p. 492–500. **DLC**—It is suggested "that an experiment should be made to see whether rain may be produced artificially in time of drought." The experiment was to be based on the principle that clouds are formed by upward currents of air. Such currents could be produced by burning large fires. Evidence is produced to the effect that rain was frequently observed in connection with major conflagrations and volcanic eruptions. (*Same item as* 6J–1. Oct. 1955, *Met. Abs.*) *Subject Heading:* **1. Artificial precipitation.**—*G.T.*

**11M–2** 551.509.617

Espy, James Pollard, **Report on Meteorology. First to Fourth.** Wash., D. C., **(1843)–1857.** 4 vol. in 3. numerous charts, tables. **DLC**—In the first Report (p. 2) the author suggests (in accordance with his theory of rain formation as an effect of upward currents) that salt marshes, prairies or timber destined to be burned should be preserved to be set on fire in drought periods; ensuing rainfall should be observed and reported. Throughout Reports 2–4 numerous instances of rainfall resulting from large fires are reported and certified. (For fuller abstract, *see* 6.2–8, Feb. 1955, *Met. Abs.*) *Subject Heading:* **1. Artificial precipitation.**—*G.T.*

**11M–3** 551.509.617

**On the causes of rain and the possibility of modifying them by art.** *Scientific American*, 8(21): 168, Feb. 5, **1853. DLC**—In this two-column communication DANIEL VAUGHAN suggests a technique for triggering the release of rainfall. Considering that electricity is liberated whenever vapor is condensed, further condensation will be retarded if the escape of electricity cannot take place. By discharging electricity in the upper part of the atmosphere rainfall may be released. A momentary communication with the imprisoned electricity may be achieved by a body of water projected into the atmosphere by pressurized air or carbonic acid. Describes the mechanism with which this could be achieved. (*Same item as* 6J–3, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation. I. Vaughan, Daniel.**—*G.T.*

## 1870

**11M–4** 551.509.617:351

**Rain and rain doctors.** *Scientific American*, New York, 2. s., 22:57, Jan. 22, **1870. DLC**—Various superstitions concerning artificial rain are described from different ages and places. Legal conflicts which would arise from rainmaking are mentioned. *Subject Headings:* **1. Artificial precipitation 2. Weather control legislation.**—*O.T.*

## 1871

**11M–5** 551.509.618:358.1

Powers, Edward, **War and the weather, or the artificial production of rain.** Chicago, S. C. Griggs & Co., **1871.** 171 p. **DWB.** Review in *American Journal of Science*, New Haven, Conn., 3. s., 2:313–314, Oct., **1871. DLC**—This book tries to prove that heavy artillery bombardment is responsible for heavier rainfall. The author gives examples from different battles fought in Mexico and Europe. But these areas usually have heavy rainfall. There is one rainfall in three days on average. As the battles are usually not fought during a rainfall, a downpour is not surprising after the battle. Thus the author's theories are not very convincing. *Subject Headings:* **1. Artificial influences on weather 2. Artillery meteorology.**—*A.H.K.*

## 1880

**11M–6** 551.509.617

Bell, George H., **Another rain controller.** *Scientific American*, New York, Ser. 2, 45(8):113, Aug. 21, **1880.**—GEO. H. BELL'S plan of a rain-tower for producing or preventing rain is described, which saturated air could be blown into the upper atmosphere, and an additional up-rush of air would be obtained by means of numerous tubes. *Subject Headings:* **1. Artificial precipitation 2. Rain towers.**—*O.T.*

**11M–7** 551.509.617

Ruggles, Daniel (*Fredericksburg, Va.*), **Method of precipitating rain-falls.** *U. S. Patent Office, Patent* No. 230,067, July 13, **1880.** [2 p.+plate] diagr. **DP**—Also: **New method of precipitating rainfalls.** *Scientific American*, 43(7):106, Aug. 14 and 43(22):342, Nov. 27, **1880.** fig. **DLC**—The method described in the patent specification involves sending up balloons carrying explosives and detonating the latter by electrical means. Rain clouds would be condensed by the force of concussion. Thus rain could be produced or be prevented from falling over a specified region by precipitating the clouds before they reach the region. (*Same item as* 6J–4, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation patents 2. Patents.**—*G.T.*

## 1884

**11M–8** 551.509.617:632.187

**Artificial production of rain.** *Science*, Cambridge, Mass., 3:276, March 7, **1884.**—A brief letter reporting an instance of the artificial production of rain. It is reported that once during a drought period in Virginia pine trees were set on fire. The smoke lifted upwards in the form of a cloud, soon thunder was heard and rain began to fall in a little more than an hour from the time of the fire. *Subject Headings:* **1. Artificial precipitation 2. Forest fire effects on rainfall.**—*I.S.*

**11M–9** 551.509.617(09)

Russell, Henry C., **The artificial production of rain.** *Science*, Cambridge, Mass., 3(55):229–230, Feb. 22, **1884.** eq.—The ideas of the government astronomer, on the subject of producing rain artificially, he presented before the Royal Society of New South Wales, are summarized in this note. RUSSEL maintained that if we could set the warm current moving upwards at a time when a cold current overlies a warm one, considerable quantity of rain might fall. *Subject Heading:* **1. Artificial precipitation.**—*I.S.*

## 1890

**11M–10** 551.509.617

**The artificial production of rain.** *Scientific American*, New York, Ser. 2, 63:384–385, Dec. 20, **1890. DLC**—Criticizes Senator CHARLES B. FARWELL'S arguments in support of congressional appropriation for rain-making. The partly favorable, partly unfavorable opinions of EDWARD POWERS in **"War and the Weather, or the Artificial Production of Rain"** (1871), those in SILLIMAN'S Journal: on battles, HUMBOLDT on volcano bursts, and Captain JAMES ALLEN'S testimony on the probability of artificial rain are cited. *Subject Heading:* **1. Artificial precipitation.**—*O.T.*

## 1891

**11M–11** 551.509.617

Gathmann, Louis (*Chicago, Ill.*), **Method of producing rain-fall.** *U. S. Patent Office, Patent* No. 462,795, Nov. 10, **1891.** [1 p.] **DP**—The method constituting this invention involves diffusion of liquefied carbonic acid in the upper atmosphere. The sudden expansion will chill the atmosphere and cause condensation. The carbonic acid, contained in a shell or casing is thrown, shot, or carried in a balloon into the upper atmosphere, where it is liberated by explosion. (*Same item as* 6J–5, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation patents. 2. Patents.**—*G.T.*

**11M–12** 551.509.617

†Gathmann, Louis, **Rain produced at will.** Chicago, **1891.** 61 refs. **DWB**—Author says rain can be produced by cooling upper regions of the atmosphere enough to condense water vapor. A method of suddenly chilling the atmosphere by rapid evaporation is designed to produce condensation in the upper air in such quantities that a cloud will form from which rain will fall. This is to be done by liberating liquefied carbonic acid gas, shot into the atmosphere or released from a balloon. (*Same item as* C–101, March 1950, *Met. Abs.*) *Subject Heading:* **1. Artificial precipitation.**

**11M–13** 551.509.617(09)

Mallen, James, **The artificial production of rain.** *Scientific American*, Ser. 2, 65:144–145, Sept., 5, **1891. DLC**—Some doubt is expressed as to the wisdom of Senator CHARLES B. FARWELL'S support of an appropriation of $10,000 by the Congress to finance Gen. DYRENFORTH'S rainmaking experiments in Midland, Texas in August, 1891. Regarding the probability of artificial rainmaking an article from the *Scientific American* of Dec. 20, 1890, is reprinted, including the motivation of a $2000 additional appropriation for experiments by the Department of Agriculture in connection with Senator FARWELL'S request. Some striking effects of cannon fire in 1793, and at the battle of Dresden, August 27, 1863, HUMBOLDT'S, Captain JAMES ALLEN'S and H. C. RUSSELL'S opinions on the effect of volcano outburst and explosion are cited. *Subject Heading:* **1. Artificial precipitation.**—*O.T.*

**11M–14** 551.509.617:629.13

Newcomb, Simon, **Can we make it rain?** *Scientific American*, New York, Ser. 2, 65:241. Oct. 17, **1891. DLC**—Extract from *North American Review*, stating aircraft to be impractical and dismissing the supposition that sound could produce rain. *Subject Heading:* **1. Artificial precipitation techniques.**—*O.T.*

**11M–15** 551.509.617:551.507.321.4

**Another rain producer (Artificial).** *Scientific American*, New York, Ser. 2, 65:326, Nov. 21, **1891. DLC**—A patent was granted in Austria on January 13, 1874 for an "apparatus for discharging electricity from hail clouds." It involves the use of a captive balloon armed with metal points or covered with metal and charged with electricity which would cause the moisture from low hail clouds to drop to earth in form of rain. A drawing shows the complete assembly. *Subject Headings:* **1. Hail prevention techniques 2. Captive balloons 3. Patents.**—*O.T.*

## 1892

**11M–16** 551.509.31:551.509.617

Noyes, Isaac P., **Meteorology. The weather map and the rain-makers; factors necessary to produce rain, man's attempt to rival them, and a few general remarks on our weather system, based on facts from the weather map.** Wash., D. C., Joseph L. Pearson, **1892.** 46 p. 8 plates, foot-ref. **DLC**—A full exposition of the current attitude of meteorologists toward the possibility of rainmaking by artificial means (cannon explosions, etc.), considering the magnitude of the processes involved, and the necessity for water vapor to be present in order to obtain precipitation. The theme is built around the knowledge gained from the study of weather maps. With various trajectories of storms or air masses, various precipitation patterns occur naturally. *Subject Headings:* **1. Artificial precipitation 2. Cyclone tracks 3. United States.**—*M.R.*

**11M–17** 551.509.617

Powers, Edward, **Rain-making.** *Science*, Cambridge, Mass., 19:52–53, Jan. 22, **1892.** **DLC**—This is a brief critical review of the article entitled, Can We Make it Rain, by LUCIEN I. BLAKE of the State University of Kansas, published in *Science*, Nov. 27, **1891.** Criticism of the paper mainly centers on two points. First, BLAKE's contention that if concussion causes rain "the greatest effect, the practical effect must follow close upon the concussion." Secondly, the special method recommended by BLAKE for conducting rain-making experiments is criticized. *Subject Headings:* **1. Artificial precipitation. I. Blake, Lucien I.**—*I.S.*

**11M–18** 551.509.617

Ward, Robert De C., **Artificial rain: a review of the subject to the close of 1889.** *American Meteorological Journal*, Boston, 8(11):484–493, March **1892.** **DLC, DWB.**—Explosions and fires are the two suggested causes of artificial precipitation. Battles occasioning rain were mentioned already by PLUTARCH and ARAGO. ESPY proposed first to test fires as a cause of rain. Very narrow storms in the West Indies increase in size by moving several thousand miles. Volcanic explosions cause rain as do fires. EPSY presented examples of rain caused after great battles also, evidently produced by heat. Similar examples were presented by J. C. LEWIS. LAUGHTON criticized ESPY's statements in the Geological Section of the British Association in 1870. POWER's book, "**War and the Weather**" published in 1871 and in 1890 initiated the artificial rain experiments in the summer of 1891, despite the many errors and omissions of very important links in its chain of evidence. The great fire in Chicago in 1871 aroused new interest despite J. A. LAPHAM'S criticism. PROF. JOHN TOWBRIDGE of Harvard finds the question of great fires still unanswered in 1872. DANIEL RUGGLES took out a patent in 1880 for producing rain by balloons carrying torpedoes to be exploded in the upper air by electric currents. GENERAL DYRENFORTH experimented with a similar balloon scheme in Texas in the summer of 1891. G. H. BELL of New York suggested in the same year a tower, 1500 feet high, blowing saturated air through its hollow center into the upper atmosphere. A system of tubes around the tower was designed to increase the volume of up-rushing air, forming clouds or prevent rain by reversing the motion. H. C. RUSSELL in an address delivered to the Royal Society of New South Wales in 1884, found the only chance for rainmaking in a condition of unstable equilibrium. MR. FERNOW, Chief of the Division of Forestry did not recommend in his report experiments to be made in the summer of 1891 because of still uncomplete and unsatisfactory theories. It is concluded that the presence of favorable conditions, as sufficient quantity of moisture in the air and favorable wind and temperature, is necessary to any artificial rainfall. *Subject Heading:* **1. Artificial precipitation.** *O.T.*

## 1894

**11M–19** 551.509.617

†Harrington, M. W., **Weather making ancient and modern: Smithsonian Report for 1894.** *National Geographic Magazine*, 6:35–62, April **1894.** 75 refs. **DWB**—Superstitions and religious methods of rainmaking and stopping are discussed, and other methods such as noise, concussion, smoke or dust, expansion of carbon anhydride, electricity, conflagration. (*Same item as* C–102, March 1950, *Met. Abs.*) *Subject Heading:* **1. Artificial precipitation.**

**11M–20** 551.509.617

Sanford, Fernando, **Rainmaking.** *Popular Science Monthly*, New York, 45(4):478–491, Aug. **1894.** **DLC**—The principles involved in the condensation of atmospheric water and their application to the molecules of the atmosphere are explained. The effect of sulphuric acid and its class of substances and other methods of condensation, the conditions necessary for producing precipitation from the atmosphere and the role of condensation due to cohesion are discussed. JOHN AITKEN'S experiments begun in 1880 are described. Rainmakers are referred to as "conscienceless fakers." POWERS, RUGGLES and DYRENFORTH are selected as examples. Even the estimated cost of about six hundred dollars per acre is ridiculous. *Subject Headings:* **1. Cloud physics 2. Artificial precipitation.**—*O.T.*

## 1900

**11M–21** 551.509.617

Abbe, Cleveland, **Artificial rain.** *Monthly Weather Review*, 28(1):22–23, Jan. **1900.** **DLC**—A note reflecting the U. S. Weather Bureau's negative attitude toward FRANK MELBOURNE and other rainmakers. MELBOURNE'S technique involved the burning of certain fume-producing chemicals. (*Same item as* 6J-6, Oct. 1955, *Met. Abs.*) *Subject Heading:* **1. Artificial precipitation.**—*G.T.*

**11M–22** 551.509.617:551.578.7

**Shooting at the clouds.** *Scientific American*, New York, Ser. 2, 83:371, Dec. 15, **1900.** **DLC**—Old and recent experiments with hail-shooting mainly in Austria, first mentioned in a decree of

Empress Maria Theresia, are discussed. It appears that cannon fire, particularly in a horizontal direction, and at the time of complete calm preceding a storm, is responsible for whirlwinds reaching up to the clouds which might produce hail. *Subject Headings:* **1. Hail shooting.**—*O.T.*

1903

**11M–23** 551.509.617(94)

Abbe, Cleveland, **The rainmaker in Australia.** *Monthly Weather Review*, Wash., D. C., 31(7): 338, July, **1903.** **DLC**—An account is given of the efforts made in Australia to increase the rainfall of certain regions. A method was devised by A. J. J. PHELPS of Sydney by using sulphuric acid and zinc. The hydrogen set free ascends in spiral columns which are hollow when they reach the rainbelt in the atmosphere. The cold air in that region rushes down to warmer air below. This experiment was not successful. One other experiment by DR. MCCARTHY is also cited. It consisted of firing chemicals into air to great distances. He also failed. An effective method to obtain rainfall is yet to be developed. *Subject Headings:* **1. Cloud seeding experiments 2. Cloud seeding techniques 3. Australia.**—*A.H.K.*

1905

**11M–24** 551.509.617(09)(794)

McAdie, Alexander G., **The Los Angeles rain-making.** *Sunset*, San Francisco, 15(6):575–577, Oct. **1905.** 2 maps, table.—In the region of Southern California, there are many stories of rainmakers and their tricks. Some people in Los Angeles offered a sum of $1,000 to a man who can produce a rainfall of eighteen inches. As the records show, a rainfall of eighteen inches is not uncommon in the region of Southern California. There is hardly any evidence that rainmaking experiments have anything to do with increased rainfall. *Subject Headings:* **1. Artificial precipitation 2. Los Angeles, Calif.**—*A.H.K.*

**11M–25** 551.509.617(794)

**Has the rainfall of Southern California been affected by any so-called rainmaker?** *Monthly Weather Review*, Wash., D. C., 37(7):309–310, July, **1905.** 2 tables. **DWB**—Discusses the superstitious belief of some people in California, that the so-called rainmaker can affect the rainfall of that region. Describes the influence which man can exert on a region. In the region between Los Angeles and SanBernardino most of the vegetation depends on the winter rainfall. The charts show that the rainfall in this region has varied from year to year and no rainmaker can claim that he was responsible for any changes. *Subject Headings:* **1. Artificial precipitation 2. California.**—*A.H.K.*

1907

**11M–26** 551.509.617(712.1)

**Rain making experiments in the Klondike.** *Meteorological Magazine*, London, 42(494):29, March **1907.** Also (same title): *Royal Meteorological Society, Quarterly Journal*, 33(143):199–200, July **1907.** **DLC**—Reprints from the Times, London, of Feb. 11, 1907, briefly reporting an unsuccessful rainmaking attempt in the Yukon Territory. The attempt was made by C. M. HATFIELD of Los Angeles. (*Same item as* 6J–7, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Klondike, Yukon Territory, Canada.**—*G.T.*

1908

**11M–27** 551.509.617:551.577.38(931)

Bates, D. C., **Report upon dry period and rainmaking experiments at Oamaru, New Zealand.** *Meteorological Magazine*, London, 43(510–512):107–111, 137–138, 156–159, July–Sept. **1908.** tables. Also issued with title: **Rain-making in New Zealand** (with comment by Cleveland Abbe). *Monthly Weather Review*, 36(7):208–213, July **1908.** fig., tables. **DLC**—Data on extensive drought in Oamaru district, N. Z. (1906–07), and detailed description of operation and results of a rainmaking project which the author observed as a meteorological expert. Explosives were fired from dynamite detonators during conditions favorable for rain formation. The operation was inconclusive; energies supplied by the detonations are negligible compared to amount of heat exchange in precipitation formation and other atmospheric processes. Climate could be more effectively improved by afforestation. (*Same item as* 6J–8, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Drought 2. Artificial precipitation 3. New Zealand. I. Abbe, Cleveland.**—*G.T.*

1909

**11M–28** 551.509.617

Van Wagenen, Theodore F., **Rainmaking by explosion.** *Scientific American*, New York, Ser. 2, 100:295, April 17, **1909.** **DLC**—The absolute rejection of the possibility of rainmaking by explosion

in an article in the issue of March 27 (see next item) is challenged. Author believes that explosions from captive balloons or kites can be effective if taking place in the proper layer of the atmosphere. *Subject Headings:* **1. Artificial precipitation 2. Explosion effects on rainfall.**—*O.T.*

**11M-29** 551.509.617(09)(931)
**Rainmaking by dynamite.** *Scientific American*, New York, Ser. 2, 100:238, March 27, **1909. DLC**—A report of BATES on his experiments in 1907 in southern New Zealand proved the impossibility of rainmaking by the relatively infinitely small power of dynamite explosion despite apparent success. This was the first attempt after the failure of similar attempts by DYRENFORTH in Texas a number of years ago. *Subject Headings:* **1. Explosion effects on rainfall 2. New Zealand.**—*O.T.*

## 1914

**11M-30** 551.509.617:358.1
**Rain after battles.** *Scientific American*, New York, 110:330, Oct. 24, **1914. DLC**—The myth of rain caused by battles is judged as nonsensical and pseudo-scientific on the basis of cloud physics. *Subject Headings:* **1. Artificial precipitation 2. Artillery meteorology.**—*O.T.*

## 1920

**11M-31** 551.509.617
Brooks, Charles F., **Professional "rain-makers."** *American Meteorological Society, Bulletin*, 1:47-48, May **1920. DWB**—Brief article warning against quack rainmakers. (*Same item as* C-104, March 1950, *Met. Abs.*) *Subject Heading:* **1. Artificial precipitation.**

## 1921

**11M-32** 551.509.617(09)
Jeffreys, Harold, **Artificial production of rain.** *Monthly Weather Review*, Wash., D. C., 49(11): 614-615, Nov **1921.** Reprinted from *Nature*, London, Nov. 3, **1921,** p. 313-314. **DLC**—The rainmaking activities of CHARLES M. HATFIELD are reported and commented upon in this note. The claims of HATFIELD do not appear to be scientifically ascertainable. *Subject Heading:* **1. Artificial precipitation.**—*I.S.*

**11M-33** 551.509.617
Palmer, Andrew H., **More about rain-makers.** *American Meteorological Society, Bulletin*, 2(5):69-70, May, **1921. DLC**—A brief note about the activities of CHARLES M. HATFIELD, the self-styled rain producer. A dispatch from *San Francisco Chronicle* is reproduced which tells about a rainmaking contract between HATFIELD and the United Agricultural Association. *Subject Heading:* **1. Artificial precipitation.**—*I.S.*

**11M-34** 551.509.617
Shaw, Charles Napier, **The artificial control of weather.** *Monthly Weather Review*, 49:244-246, April **1921. DWB**—Resumé of a lecture delivered before the Cambridge University Aeronautical Society. Various methods are suggested for producing rain, including electrical methods, discharge of dust into the atmosphere, detonations, etc. It is said, "Mr. Cole, a Canadian airman, suggests rain production by means of liquid air sprayed from an aeroplane. While a certain amount of condensation is thus assured, there is a risk that the rain might evaporate before reaching the ground.—To water a countryside would need a good deal of liquid air." (*Same item as* C-105, March 1950, *Met. Abs.*) *Subject Heading:* **1. Artificial precipitation.**

**11M-35** 551.509.616:551.576.11(44)
Varney, Burton M., **The Argonne battle cloud.,** *Monthly Weather Review*, Wash., D. C., 49(6): 348-349, June, **1921. DWB**—Based on the quoted description of eyewitnesses of unusual clouds formed over the Argonne battle front in the autumn of 1918, PROF. HUMPHREYS suggested the probably correct explanation that the end products of complete combustion could result in more than a gallon of water per gallon of gasoline consumed. The author suggests if supersaturation can occur in the free air, and atmospheric vibration set up by the exhausts from the engines, the volume of air involved would be sufficient to furnish water for the formation of a visible cloud. *Subject Headings:* **1. Artificial cloud formation 2. Argonne, France.**—*O.T.*

**11M-36** 551.509.617
**Rain-making again!** *Monthly Weather Review*, Wash., D. C., 49(7):412, July, **1921.** Reprinted from *Nature*, London, July 21, **1921,** p. 659. **DLC**—In this note a question asked in the House of

Commons about rainmaking in 1921 and the answer given are briefly reported. The question asked by MAJ. MORRISON-BELL raised the issue of the role of explosions in precipitating rainfall. The answer given expressed the opinion of the meteorologists that explosions do not induce a fall of rain. *Subject Heading:* **1. Explosion effects on rainfall.**—*I.S.*

## 1922

**11M–37** 551.509.617(09)

Hering, D. W., **Weather control.** *Scientific Monthly*, New York, 14(2):178–185. Feb., **1922.** 2 plates. **DLC**—Through ages humanity has worshipped deities which stood for various superstitions. Severe weather conditions often result in suffering. These difficulties lead to worship of Weather Gods in ancient pagan civilizations. In recent years the scientists have resorted to the study of means of weather control. In America, JAMES POLLARD ESPY has done theoretical work on cloud formation. In 1871, EDWARD POWERS published data in his book to prove that heavy cannonading results in rainfall even in dry regions. Later this theory was denounced. Weather control by artificial means is, however, not ruled out completely and various methods have been tried such as the cannon perfected in 1896 by ALBERT STIGER to repel and break up storms. *Subject Headings:* **1. History of weather control 2. Progress in weather control.**—*A.H.K.*

## 1923

**11M–38** 551.509.617

**Sand blasting the clouds for man-made weather.** *Scientific American*, April **1923.** p. 13. **DLC**—Description of spraying clouds with electrically charged sand, to produce rain. (*Same item as* C–106, March 1950, *Met. Abs.*) *Subject Heading:* **1. Artificial precipitation.**

## 1926

**11M–39** 551.509.617:551.577.1

Humphreys, William Jackson, **Rainmaking and other weather vagaries.** Baltimore, Williams and Wilkins Co., **1926.** 157 p. refs. p. 92. **DWB**—Part I. Account of magical, religious, and (pseudo-) scientific rain-making attempts. Clearing away clouds and fog, fighting hailstorms, drought, and how nature produces rain are discussed. (*Same item as* C–107, March 1950, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Precipitation formation 3. Weather lore.**

## 1927

**11M–40** 551.509.617:551.577.1

Wendler, August, **Das Problem der technischen Wetterbeeinflussung.** [The problem of technical weather control.] *Probleme der Kosmischen Physik*, Hamburg, No. 9, **1927.** 107 p. 4 figs., 104 refs. **DLC**—Existing knowledge in the field of artificial influencing of weather is reviewed, including various methods with gunfire, detonations, electricity, etc., in Australia, America, and other countries. Effects of smoke, forest fires, cities, forests, the sea, etc., are considered. Research in precipitation formation, condensation nuclei, conditions of instability, release of heat energy, etc., are discussed. (*Same item as* C–108, March 1950, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Precipitation formation.**

## 1930

**11M–41** 551.509.617

Berg, A., **Bemerkungen über das Verfahren des Herrn A. Veraart (Rijswijk) zur Erzeugung künstlicher Regen.** [Comments on the technique of A. Veraart (Rijswijk) for producing artificial precipitation.] *Zeitschrift für angewandte Meteorologie*, 47(6):161–171, June **1930. DWB**—Critical examination of VERAART'S claims that condensation of 20,000 kg water vapor may be obtained through the cooling power of 2000 kg ice of −100°C. According to the author's calculations 50,000 and not 2000 kg ice would be required for such an effect and this quantity would have to be dispensed at an impracticable rate. Rain water thus obtained would be economically insignificant, if it ever reached the ground. (*Same item as* 6J–9, Oct. 1955, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding with ice.**—*G.T.*

**11M–42** 551.583

Dessoliers, Hippolyte, **Refoulement du Sahara.** [Reclamation of the Sahara.] Pt. 1, 2nd ed. Algiers, **1930.** 158 p. map, 2 graphs, refs. **NNA**—In a fairly extensive and detailed treatise, author describes the climatic conditions and drawbacks of the Sahara, the geographical and meteorological causes of the desert and climatic change and drying up of the earth in general. He seeks to

present theories and schemes by which man, through better understanding of the dynamics and processes of the atmosphere, can learn to control weather and thereby prevent the waste of this vast desert region. (*Same item as* 3A–113, January 1952, *Met. Abs.*) *Subject Headings:* **1. Arid zones 2. Climatic effects of weather control 3. Sahara Desert, Africa.**

**11M–43** 551.509.617(61)

Dubuc, E., **Les pluies artificielles par le procédé Dessoliers.** [Artificial rainfall by the Dessoliers process.] *La Géographie*, Paris, 51(1/2):39–43, Jan./Feb. **1930. NNA**—Rain producing scheme of DESSOLIERS is explained, based on theory of the tropical atolls of the Pacific where water evaporates from the central lagoon and causes cloud and rain over the island. He would apply scheme to the Barbary Coast, North Africa, to insure rainfall by reconstructing physical conditions similar to the atolls in the small lakes left by the winter rains in hilly regions of the Barbary Coast, around which agricultural areas would develop. Problem of the dryness of the North African air is considered. (*Same item as* 3A–114 and 6J–10, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. North Africa.**—*H. P. Kramer.*

**11M–44** 551.509.617(492)

Grunow, Johannes, **Der künstliche Regen des Holländers Veraart.** [The artificial rain of the Dutchman Veraart.] *Umschau*, 34(30):602, **1930.** Photostat copy. **DWB**—Theory of rain formation. Description of Veraart's experiment of dropping in a cloud 1500 kg of powdered ice cooled to −78°C. with dry ice. Pilots of four airplanes verified that along a 10 km. strip of the Zuider Zee streaks of rain were produced. It was not proven that the rain reached the earth. Earlier experiments of K. WEGENER (1923) are reviewed in which he poured liquid air from an airplane at the base of a cloud, without appreciable results. It was concluded impossible to produce rain over a large enough area, especially in times of drought, since at such times the air is stable, clouds scarce, and surface air so dry that rain would evaporate before reaching the ground; and when conditions are favorable, nature takes care of making it rain. (*Same item as* C–110, March 1950, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with dry ice 2. Netherlands.**—*M.R.*

**11M–45** 551.509.617(492)

**Clouds sprayed with dry ice made to yield rain.** *Popular Mechanics*, 54(3):418, Sept. **1930. DLC**—Brief report of a Dutch scientist's (August W. Veraart) rainmaking experiments. The theory is postulated that falling particles of dry ice become laden with electricity transforming them into numerous very small drops; these convert the clouds into larger drops causing them to dissolve or condense into rain. (*Same item as* C–109, March 1950, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with dry ice 2. Netherlands.**

**11M–46** 551.509.617

**Patents for rainmaking devices.** *Science*, N. Y. 72, Aug. 15, **1930,** Science New Supplement (Bound at end of Vol. 72), (7th section), p. x–xii. **DLC**—A note written during the drought period warning people, in general, and the farmers, in particular, about the exaggerated and unfounded claims of the rainmakers. Rainmakers have been careful to protect their devices by obtaining patents from the government. Notwithstanding, the officials of the U. S. Weather Bureau declared these devices as pseudo-scientific and unreliable. *Subject Heading:* **1. Artificial precipitation patents.** —*I.S.*

## 1931

**11M–47** 551.509.617(492)

van Everdingen, E., **De Zware Regenval op 6/7 October 1930.** [Heavy rainfall of 6/7 Oct. 1930.] *Hemel en Dampkring*, 29(10):321–2, Oct. **1931.** fig. **DWB**—An analysis of the rainfall and air-flow over Holland on the day following the last demonstration by AUGUST VERAART (see 11M–50). A chart is included to prove that Veraart's claim to have artificially produced a record rainfall over all of Holland, was greatly exaggerated; and that the prevailing air-flow was from the WNW, not the WSW as was claimed by Veraart: hence the heavy rainfall at Hoorn during the night could not have been produced by seeding air masses which by that time were far to the eastward and inland. (*Same item as* C–111, March 1950, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with dry ice 2. Weather control 3. Netherlands.**—*M.R.*

**11M–48** 551.509.617(492)

Veraart, August W., **Meer Zonneschijn in het Nevelig Noorden; meer Regen in de Tropen.** [More sunshine in the foggy north; more rain in the tropics.] Amsterdam, N. V. Seyffardt's Boek & Muziekhandel, **1931.** 32 p. 6 refs. Photostat copy. **DWB**—History of author's interest in and ten years' experimenting with artificial rain production. Economic advantages of such control; possible methods of modification of clouds, fog, thunderstorms, and rain; experiments with

seeding of clouds with dry ice, supercooled water-ice and carbon dioxide mixtures, ammonium salts, etc. Dates of public demonstrations in Holland: Soesterberg, July 3 and 19, and Scheveningen, Aug. 7 and Oct. 6, 1930. Explanation of possible physical effects: upset of stability or release of latent instability in clouds, release of latent heat and resulting convection and turbulence, propagating waves producing divergent effects at great distances, cooling of supercooled and supersaturated clouds by "tens of thousands of swirling and undulating ice particles." (*Same item as* C–112, March 1950, *Met. Abs.*) *Subject Headings:* **1. Weather control 2. Netherlands.**—*M.R.*

**11M–49** 551.509.617(492)

Veraart, August W., **Meer Zonneschijn in ons Nevelig Noorden.** [More sunshine in the foggy North.] *Natuur en Techniek*, April **1931.** p. 24–28. 6 photos. **NNM**—A summary of Veraart's work and theories, together with pictures of various types of clouds—both fair and bad weather types, taken in the region of Holland and in the tropics. The gist of the author's theory is that the dry ice or ice mixtures cool the upper inversion layer which prevents the further growth of the cloud, and increases the moist instability, thus setting off rapid convective activity that might otherwise not be realized. He also thought that the rapidly falling ice particles upset the electric field of cloud and that myriads of ice particles swirling in a supercooled ( −10° to −20°C) cloud of water droplets would produce condensation and liberate latent energy resulting in further convection and even in self-propagating effects. Extravagant possibilities of controlling weather through these means are developed at some length. (*Same item as* C–113, March 1950, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with dry ice 2. Netherlands.**—*M.R.*

**11M–50** 551.509.6(492)

Veraart, August W., **Opzienbarende cijfers: officieele rapporten van De Bilt na de proeven van den heer Veraart.** [Sensational data: official reports from De Bilt on the demonstrations of Veraart.] *Natuur en Techniek*, 1(5):183–185, Aug. **1931.** fig. **NNM, DWB**—Dry ice was seeded in clouds Oct. 6 and 7, 1930, and rainfall data for Holland during that period showed that heavier rain fell then than at any time previously, (although in some places this was not the case). A rough isoline chart of the Netherlands shows the heaviest rain (35 to 53 mm.) fell in a strip from the North Sea coast inland across the Zuider Zee to the mainland, just northeast of Amsterdam, with decreasing amounts to the northeast and southwest of that strip. More than 80% of this fell from 4:30 p.m. on the day of the demonstration to 8 a.m. the next day. The ice was dropped from the airplane upwind between 3:45 and 4:30 p.m. (Oct. 6, 1930). A rain squall was seen under the cloud by a second pilot ten minutes after the ice was dropped, and the cloud was seen to increase in depth by ten times. The author claims that precipitation induced in one cloud sets off precipitation in neighboring clouds as the system moves along. (*Same item as* C–114, March 1950, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with dry ice 2. Netherlands.**—*M.R.*

**11M–51** 551.509.617(492)

Veraart, August W., **Voorloopig antwoord aan Prof. Dr. E. van Everdingen in verband met het artikel "Zware Regenval op 6/7 Oct. 1930."** [Provisional answer to Prof. Dr. van Everdingen in connection with the article "Heavy rainfall of 6/7 Oct. 1930."] Photostat copy, **1931. DWB**—Included in this paper is a summary of dry ice and dry ice and water-ice cloud seeding experiments in the top of supercooled clouds made by VERAART; published results (all in Dutch newspapers or periodicals); and scientific basis for belief that rain was actually produced on several occasions during 1930 with verification by pilots and reporters who witnessed demonstrations. This tract is written in answer to a criticism (*see* 11M–47) by PROF. VAN EVERDINGEN, head of the Royal Dutch Meteorological Service. Appended is a letter from Veraart to the Minister of Education, Art and Science, dated 9 Nov. 1931, defending his experiments and his knowledge of cloud physics against VAN EVERDINGEN'S charge that he is a non-meteorologist and charlatan. The two page report from VAN EVERDINGEN to the Minister is appended. VAN EVERDINGEN gives scientific reasons why Veraart's claim of success Oct. 6, **1930,** is exaggerated, and further recommends that a subsidy of 1,000 fl. be refused Veraart. (*Same item as* C–115, March 1950, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with dry ice 2. Netherlands.**—*M.R.*

## 1932

**11M–52** 551.509.617:551.578.7

Kleinschmidt, E. (*Stuttgart*), **Das Hagelschiessen.** [Hail shooting.] *Zeitschrift für Angewandte Meteorologie*, 49(11):321–330, Nov. **1932.** ref. **DWB**—Upon examining various arguments advanced in favor of the possible effectiveness of hail shooting, the author finds that hail rockets of the type used at the time cannot effectively prevent hailfall either by sound waves or by heat, the supply of condensation nuclei (overseeding), or the generation of electrical charge. Statistical data presented give no indication of any result from hail shooting. Even if results were favorable,

the cost of operation would exceed the damage caused by hail. (*Same item as* 6J–11, Oct. 1955, *Met. Abs.*) *Subject Heading:* **1. Hail shooting.**—*G.T.*

**11M–53** 551.509.617(492)

Veraart, August W., **Records van zonneschijn en regen in 1930. Rede gehouden voor de K.R.O. microfoon op Zondag 29 Mei 1932.** [Records of sunshine and rain in 1930. Speech made before the KRO radio on Sunday, May 29, 1932.] Photostat copy. **DWB**—This is the last publication by Veraart before he died. Mention is made of a test by the Soviets in Moscow-Leningrad region wherein they claimed to have produced precipitation from clouds. Author analyzes sunshine and precipitation records for all of Holland for June, 1930, and compares the monthly rainfall for June–Nov. 1930, with normal and extreme years, in an attempt to prove that his experiments resulted in the rainiest summer on record. Dates and places of the various demonstrations are given and height (3000 to 4000 m) at which the dry ice and water ice mixture was dropped from the plane. He summarizes the physical basis for his experiments: 1) that extreme vertical turbulence and waves are set up when myriads of ice particles suddenly fall through a cloud mass; 2) that this is especially true when the cloud top consists of supercooled water drops at $-10°$ to $-20°$C (an extremely unstable condition); 3) that often these clouds are more than 100% saturated with respect to water, and if ice forms, intense precipitation can result; 4) the volume of gaseous $CO_2$ at this low temperature is 700 times greater than the solid $CO_2$, so a small amount of the latter could cause a great deal of cooling and displacement. The author also points out that it often rains more by night than by day in places where the cloud tops cool faster than the bases (low clouds over warm water masses), and he proposes to produce both more rain and more sunshine by setting off the rain before dawn, allowing the sky to become less saturated by day, increasing sunshine, and reducing chances of thunderstorms and hail. (*Same item as* C–116, March 1950, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding 2. Netherlands.**—*M.R.*

## 1938

**11M–54** 551.509.617

Görög, Henrik and Rovó, Aladár, **Kísérlet mesterséges eső előállítására.** [Attempt at artificial production of rain.] *Időjárás*, Budapest, 14(1/2):2–9, Jan./Feb. **1938.** Summary p. 43–45. **DLC**—Considering the theory that forest or prairie fires might so affect the latent saturation and instability conditions of the atmosphere so as to cause precipitation, it is suggested that a layer of oil spread on water and ignited might under favorable conditions cause rainfall for relief of drought. Amount of energy produced and its effect on the atmosphere are calculated, as well as the amount of possible resulting rainfall. Allowance is made for losses due to radiation, evaporation, divergence, etc. Comments on the paper by W. Dickson of the Ministry of Agriculture in Ottawa are included. (*Same item as* C–117, March 1950, *Met. Abs.*) *Subject Heading:* **1. Artificial precipitation.**—*M.R.*

**11M–55** 551.575.1:551.509.615

Houghton, H. G. and Radford, W. H., **On the local dissipation of natural fog.** *Papers in Physical Oceanography and Meteorology*, Cambridge, Mass., vol. 6, No. 3, Oct. **1938.** 63 p. **DWB**—The possibilities of fog dissipation are discussed. A method is suggested and described for spraying fog with calcium chloride solution, and a new type of apparatus is described for the dissipation of fog by means of fine hygroscopic particles. (*Same item as* C–118, March 1950, *Met. Abs.*) *Subject Heading:* **1. Artificial fog dissipation.**

## 1939

**11–M56** 551.509.615

Pleasants, Clellan Ross, **Method for vapor clearing.** *U. S. Patent Office, Patent* No. 2,160,900, June 6, **1939.** [2 p.] Also his: **Method and composition for dispelling vapors.** Patent No. 2,232,728, Feb. 25, **1941.** [3 p.] **DP**—In these documents the inventor describes his method of dispelling fog by dispersal of finely divided particles of amorphous carbon coated with a hygroscopic agent. (*Same item as* 6J–12, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Fog dissipation patents 2. Patents.**—*G.T.*

## 1944

**11M–57** 551.509.617:551.577.1

Puig, Ignacio, **Se puede provocar artificialmente la lluvia?** [Is it possible to produce artificial rain?] *Revista Meteorológica*, Montevideo, 3:56–62, **1944. DLC**—Review of early experiments to make rain by cannon fire, chemical brews, etc. in Australia, U. S., and France. Three processes of natural formation of precipitation are discussed briefly: direct cooling, mixtures of masses of cold and warmer air, and adiabatic cooling. (*Same item as* C–119, March 1950, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Precipitation formation.**

## 1946

**11M–58** 551.578.41:551.509.617

Schaefer, Vincent J., **The production of ice crystals in a cloud of super-cooled water droplets.** *Science*, 104:457–459, Nov. **1946.** 2 figs., (photographs of snow crystals), ref. **DLC**—It is reported that supercooled liquid water clouds spontaneously transform from water to ice when the temperature is −35°C or lower. At temperatures of −20°C the addition of fine particles of a wide variety of substances is without effect on the supercooled cloud. (*Same item as* C–121, March 1950, *Met. Abs.*) *Subject Heading:* **1. Ice crystal formation.**

**11M–59** 551.509.617

**Man-made snowstorms: scientist can make it fall in laboratory or in the sky.** *Life*, Chicago, 21:52–54, Dec. 30, **1946.** illus. **DLC**—Brief popular report of Vincent Schaefer's experiments of seeding clouds with dry ice. Good photographs. (*Same item as* C–120, March 1950, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding experiments.**

## 1947

**11M–60** 551.509.617:551.577.11(94)

Bannon, J. K., **Artificial stimulation of rain formation.** *Meteorological Magazine*, London, 76(902):169–174, Aug. **1947.** 6 refs. **DWB**—Australian experiments in cloud seeding with dry ice are reviewed. Formation of rain in the cloud; formation of ice crystals and consequent release of heat; change in the saturated adiabatic lapse rate of temperature; conditions favorable for stimulation of clouds are discussed. Discussion. Meteorological Magazine, [London], 77:62–64, **1948.** (*Same item as* C–122, March 1950, *Met. Abs.*) *Subject Headings:* **1. Precipitation formation 2. Cloud seeding in Australia 3. Australia.**

**11M–61** 551.509.617

Bee, E., **Weather overseas. Helping it to rain: Australian scientists "interviewed."** *Weather*, London, 2:153–156, **1947.** plate, ref. **DLC**—Report of dry ice cloud seeding near Sydney, 1947, and description of other Australian experiments "of the same kind" requiring "massive cumulus clouds." It is emphasized that details of this process of rain formation are not yet understood. Some discussion of theory of precipitation formation is included. Suggestion is made that other substances (unspecified) having shapes similar to ice crystals might be introduced into clouds as nuclei. (*Same item as* C–123, March 1950, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Australia 2. Australia.**

**11M–62** 551.509.617

Black, Charles L., **Making rain with an airplane.** *Flying*, 41(5):28–29, Nov. **1947.** illus. **DLC**—Popular article tells difficulties, cautions and details of rain production from supercooled clouds. (*Same item as* C–124, March 1950, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding.**

**11M–63** 551.509.617:551.577.11

Brandejs, Stanislav, **Umělé srážky.** [Artificial precipitation.] *Meteorologické Zprávy*, Prague, 1:71–72, **1947.** refs. **DWB**—Brief article discusses cloud seeding experiments of KRAUS and SQUIRES, LANGMUIR and SCHAEFER, and ice crystal theories of BERGERON, FINDEISEN, PEPPLER, etc. (*Same item as* C–125, March 1950, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding 2. Precipitation formation.**

**11M–64** 551.509.617

Brun, Edmond and Demon, Lucien, **Sur la formation artificielle de la pluie.** [Artificial formation of rain.] *Académie des Sciences, Paris, Comptes Rendus*, 225(12):505–506, Sept. **1947.** ref. **DLC**—Report of dry ice seeding experiments in the laboratory. (*Same item as* C–126, March 1950, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding experiments.**

**11M–65** 551.509.617

Francis, J., **Peut-on "faire pleuvoir."** [Can one make it rain.] *Science et Vie*, Paris, 72(362): 256–258, **1947.** fig., 2 refs. **DLC**—Popular style article discusses theory of dry ice seeding and its practicality. Use of liquid air for inducing precipitation is mentioned. (*Same item as* C 128, March 1950, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding with dry ice.**

**11M–66** 551.509.617:551.509.312

Kaempffert, Waldemar, **Making weather to order.** *Science Digest*, 22(5):1–5, Nov. **1947.** **DLC**—Part I. Popular account of cloud seeding experiments of LANGMUIR, SCHAEFER, and VONNEGUT. Besides dry ice, silver iodide, lead iodide, iodoform, iodine crystals, apatite, nephelite, wurtzite, zincite, and cerium oxide were used as nuclei. Part II. A project of ZWORYKIN and VON

NEUMANN for forecasting by use of electronic calculating machines is discussed. (*Same item as* C–130, March 1950, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding 2. Weather forecasting.**—*M.R.*

**11M–67** 551.509.617(94)

Kraus, E. B. and Squires, P., **Experiments on the stimulation of clouds to produce rain.** *Nature*, London, 159:489, **1947.** 6 figs., 3 refs. **DLC**—Report of dry ice seeding tests carried out in Australia. Radar observations made. Photographs taken. (*Same item as* C–131, March 1950, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Australia 2. Australia.**

**11M–68** 551.509.617

McDonald, Angus, **Weather prophets and rain-makers.** *New Republic*, New York, 116(11):33, March 17, **1947.** Also his: **Rain makers.** *Ibid.*, 117(16):34–35, Oct. 20, **1947. DLC**—The early history and experiments of rainmaking are reviewed. IVAN RAY TANNEHILL'S book "Drought, Its Causes and Effects" is cited as answering most of the questions about controlling rainfall. The disappointment with early rainmakers in the Middle West is remembered, Irving Langmuir's dry-ice experiments and the research at General Electric Research Laboratory and Vincent Schaefer's work are reviewed. V. K. ZWORYKIN'S suggestion of electric computing devices is mentioned. The meteorologists' unanimous skepticism and their advice for more research is stressed. "Unfortunately farmers have already been persuaded that the rainmakers will make a drought a thing of the past." *Subject Heading:* **1. Artificial precipitation.**—*O.T.*

**11M–69** 551.509.617(795)

Richards, Leverett G., **How to make it rain.** *Country Gentleman*, 117(8):15, Aug. **1947.** 3 photos. **DLC**—Popular report of dry ice seeding experiments in Oregon. Schaefer's work also reviewed, and mention is made of Australian experiments. (*Same item as* C–133, March 1950, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding in Oregon.**

**11M–70** 551.578.41:551.509.617

Schaefer, Vincent J., **Methods of dissipating clouds in the natural atmosphere.** *Institute of Navigation, London, Journal*, 1(7/8):172–174, Sept./Dec. **1947.** ref. **DLC**—Production of snow from supercooled clouds in the natural atmosphere is discussed. (*Same item as* C–134, March 1950, *Met. Abs.*) *Subject Headings:* **1. Precipitation formation 2. Artificial cloud dispersal.**

**11M–71** 551.509.617

Spencer, Steven M., **The man who can make it rain.** *Saturday Evening Post*, 220:24–25, Oct. 25, **1947.** Popular account of SCHAEFER'S and others' rainmaking tests, painting a bright picture of economic and meteorological possibilities of cloud seeding. (*Same item as* C–135, March 1950, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding.**

**11M–72** 551.574.2:551.509.617

Vonnegut, Bernard, **The nucleation of ice formation by silver iodide.** *Journal of Applied Physics*, 18(7):593–595, July **1947.** table, 2 refs. **DLC**—Pure silver iodide crystals, being similar in structure to ice crystals, are found to produce many thousands of times as many ice nuclei as impure silver iodide or lead iodide. Generator for producing silver iodide nuclei is described. Experiments are conducted. (*Same item as* C–136, March 1950, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding with silver iodide.**—*M.R.*

**11M–73** 551.509.6

**Can science do something about your town's weather?** *Science Illustrated*, Albany, 2(5):13–17, May **1947.** illus. **DLC**—Questions are discussed on the prevention of rain waste, land waste, prevention of snow in cities, reduction of hail damage, cooling of cities in summer, dispelling of fog, averting of thunderstorms, detouring of hurricanes, and prevention of tornadoes. (*Same item as* C–127, March 1950, *Met. Abs.*) *Subject Heading:* **1. Weather control.**

**11M–74** 551.509.617:551.578.46:546.264

**Man makes snow.** *Science Illustrated*, Albany, 2(1):8–10, Jan., **1947.** 5 figs. **DLC**—Brief note about artificial snowfall from a real cloud as a result of experiments undertaken by General Electric scientists. During this particular experiment dry ice was dropped from a plane 14,000 feet up. A three-mile cloud was transformed into snow that fell 3,000 feet. *Subject Headings:* **1. Artificial snowfall 2. Cloud seeding with dry ice.**—*I.S.*

**11M–75** 551.509.617

**Pluie artificielle déclenchée par la glace sèche.** [Artificial rain released by dry ice.] *Sphere*, 189(2463):68, April 19, **1947.** 2 photos. **DLC**—Photographic records of Australian and American

dry ice seeding experiments with short explanatory note. (*Same item as* C–132, March 1950, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding.**

## 1948

**11M–76** 551.577.11:551.509.617

Bannon, J. K., **Rain making.** *Weather*, London, 3(9):261–266, Sept. **1948.** 2 plates, 11 refs. **DLC**—Discussion of BERGERON'S theory of rain formation; artificial seeding of clouds; physical change in a seeded cloud; seeding at temperatures above freezing; Langmuir's breaking-drop theory; practical possibilities. (*Same item as* C–137, March 1950, *Met. Abs.*) *Subject Headings:* **1. Precipitation formation 2. Cloud seeding.**

**11M–77** 551.509.617(71)

Bassett, Cyril, **Plan rainmaking research in Canada.** *Canadian Aviation*, 21(9):18–19, Sept. **1948.** illus. **Part 2,** *Ibid.*, 21(10):35, Oct. **1948.** (unchecked.) **DLC**—Plans of National Research Council, Ottawa, to conduct cloud-modification investigations are outlined. (*Same item as* C–138, March 1950, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Canada 2. Canada.**

**11M–78** 551.509.617(71)

Canada, Meteorological Div., **Statement of present status and practical applications of artificial inducement of precipitation from clouds.** Also: **Statement on investigation of artificial precipitation in Canada.** *Canada. Meteorological Division, CIR*-1470, TEC-47, July **1948.** 4 p. **DWB**—(*Same item as* C–139, March 1950, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Canada 2. Canada.**

**11M–79** 551.509.617

†*Coons, R. D.; Gentry, R. C., and Gunn, Ross, **First partial report on the artificial production of precipitation: stratiform clouds—Ohio, 1948.** *United States. Weather Bureau, Research Paper*, No. 30, Aug. **1948.** 63 p. 52 figs., 2 tables, 22 refs. Summary in *American Meteorological Society, Bulletin*, 29(5):266–269, May **1948.** 2 tables, 4 refs. **DWB**—Preliminary report of results of the Cloud Physics Project carried on jointly by U. S. Air Force, National Advisory Committee for Aeronautics and U. S. Weather Bureau. The objective is to determine in definite quantitative terms the practical limits and general utility of cloud modification processes in producing or suppressing precipitation and increasing visibility for aircraft. Experiments are described in detail, and data tabulated. Results suggest that modification of supercooled clouds by artificially produced ice crystals does not normally result in precipitation of economic importance. (*Same item as* C–140, March 1950, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding effectiveness.**—*M.R.*

**11M–80** 551.509.617

Drake, Lawrence, **Rainmakers are all wet.** '48. *The Magazine of the Year*, 2(3):61–70, March **1948.** 2 figs. **DLC**—Discussion of attempts to produce artificial rain by seeding clouds with dry ice. Author quotes authorities to refute optimistic claims made by journalists regarding such experiments. (*Same item as* C–141, March 1950, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding.**—*M.R.*

**11M–81** 551.509.617

Durst, C. S., **Assembly of the U.G.G.I. at Oslo, Aug. 1948. Discussion.** *Meteorological Magazine*, London, 77(918):266, Dec. **1948. DLC**—One paragraph summary of rainmaking discussions at the U.G.G.I. Assembly at Oslo; papers by REICHELDERFER, BERGERON, PAWSEY, noted. (*Same item as* C–142, March 1950, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Cloud seeding 3. Symposia.**

**11M–82** 551.509.617(44)

Eyraud, René, **Sur quelques expériences de pluie artificielle.** [On some artificial rain experiments.] *Académie des Sciences, Paris, Comptes Rendus*, 226:829–831, March **1948. DLC**—Results of artificial rain making attempts in France 1947 to 1948. Precipitation occurred several times, but only when temperature at the summit of clouds was well below 0°C. No quantitative check was made on amount of precipitation that reached the ground. (*Same item as* C–143, March 1950, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in France 2. France.**

**11M–83** 551.509.617

Farwell, Charles A., **Past experiments and future prospects of artificial rainmaking.** *Sugar Bulletin*, New Orleans, 27(2):24–26, **1948. DA** (65.9Am32)—From tests with dry ice-seeding of rain clouds in Louisiana it was concluded that "under proper conditions, the production of rain by the dry ice method can become a routine procedure. Our biggest problem now is with proper cloud

conditions to be able to drop the rain where we want it, and when we want it." (*Same item as* C–145, March 1950, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding with dry ice.**

**11M–84** 551.574.11:551.509.617

Howell, Wallace E., **Experiments in the nucleation of clouds with dry ice.** *U. S. Air Force. Air Materiel Command. Technical Report* No. 5676, p. 352–383, June **1948.** 12 figs., table. **DLC**—Experiments in releasing dry ice into clouds by various means and under various weather conditions. (*Same item as* C–146, March 1950, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding with dry ice.**

**11M–85** 551.509.617:551.577.1(773)

*Huff, Floyd A. and Stout, Glenn E., **Report of May–June 1948 rainfall in the vicinity of El Paso, Illinois. In cooperation with Pfister Hybrid Corn Company.** Illinois State Water Survey, Aug. **1948.** 7 p. 2 tables. Also their **Report of July 1948 rainfall** . . . pub. Aug. 16, **1948.** 2 figs., 2 tables. Also their **Report of Aug. 1948 rainfall** . . . pub. Sept. 20, **1948.** 4 p. table, chart. Also their **Report of September 1948 rainfall** . . . pub. Oct. 27, **1948.** 2 p. table. **DWB**—Daily and monthly totals from a network of 47 gages over 250 sq mi established with a radar set for the evaluation of natural and induced precipitation. (*Same item as* 6F–35, June 1955, *Met. Abs.*) *Subject Headings:* **1. Diurnal precipitation data 2. Artificial precipitation 3. Cloud seeding evaluation 4. El Paso, Ill.**—*A.A.*

**11M–86** 551.509.617(68)

King, J. et al., **Artificial stimulation of rain.** *Nature*, London, 162:921, Dec. **11, 1948.** table. **DLC**—Letter to the Editor: Report of experiments of the South African Council for Scientific and Industrial Research to examine practical possibilities of artificial stimulation of precipitation. Experiments using dry ice noted. (*Same item as* C–147, March 1950, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in South Africa 2. South Africa.**

**11M–87** 551.576.11:551.509.617

Langmuir, Irving, **The growth of particles in smokes and clouds and the production of snow from supercooled clouds.** *American Philosophical Society, Proceedings*, 92(3):167–185, **1948.** 14 figs., 3 tables. **DLC**—This paper, delivered before the National Academy of Sciences, Nov. 17, 1947, gives a survey of: methods for generating smoke, later used in generating silver iodide particles; airplane static and icing conditions; theory of formation of ice and snow particles from supercooled water droplets, Mount Washington observations; development of Schaefer's dry ice experiments; theories of ice crystal nuclei; cloud seedings; chain reactions of snow flakes; growth of particles in clouds; water seeding theory; hurricane studies. (*Same item as* C–148, March 1950, *Met. Abs.*) *Subject Headings:* **1. Precipitation formation 2. Cloud seeding techniques.**

**11M–88** 551.578.1:551.509.617

†*Langmuir, Irving, **Production of rain by a chain reaction in cumulus clouds at temperatures above freezing.** *Journal of Meteorology*, Boston, 5:175–192, Oct. **1948.** 12 tables, 12 refs., 42 eqs. **DWB**—Theory of cloud droplet growth. Natural processes in formation of heavy rain. Accretion theory of growth of raindrops. Deposition of rime on cylinders, spheres and ribbons. Calculation of terminal velocity of a falling drop, of effective efficiency of droplet collection by falling drops; rate of growth of falling drops by accretion; Hawaiian experiments in seeding above 0°C, rain produced by chain reaction; types of rain and snow in response to seeding; self propagation of storms; divergent weather effect. (*Same item as* 1–109, C–149 and 6F–37, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Precipitation formation 3. Cloud seeding in Hawaii 4. Drop accretion 5. Langmuir's theory.**

**11M–89** 551.509.617(969)

Leopold, Luna B. and Halstead, Maurice H., **First trials of the Schaefer-Langmuir dry-ice cloud seeding technique in Hawaii.** *American Meteorological Society, Bulletin*, 29(10):525–534, Dec. **1948.** 4 figs., 2 tables, 7 refs. **DWB**—Dry ice seedings were made to determine whether rain could be induced from cumulus clouds at temperatures above freezing. Precipitation resulted in some cases. Cloud thickness was considered a significant factor. (*Same item as* C–150, March 1950, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Hawaii 2. Hawaii.**

**11M–90** 551.576.11:551.509.617

†Ludlam, F. H., **The forms of ice clouds.** *Royal Meteorological Society, Quarterly Journal*, 74:39–56, **1948.** 8 figs., 4 plates, 25 refs. **DWB**—It is suggested from observations that ice clouds arise at saturation with respect to water and at supersaturation with respect to ice, which in combination with a sparsity of effective nuclei leads to rapid growth and high falling speed of the few ice particles. Summary is given of recent theoretical and experimental work. Discussion of fibrous

structures of ice-clouds and how processes of decay and formation of clouds come about. Possible practical applications are suggested for dispersing natural clouds and producing rain by artificial ice nuclei. (*Same item as* C–151, March 1950, *Met. Abs.*) *Subject Headings:* **1. Cloud formation 2. Cloud seeding.**

**11M–91** 551.509.615

Pauthenier, Marcel, **Sur la coalescence électrique des brouillards et éventuellement des nuages à température quelconque au moyen d'aérosols électrisés.** [Electrical coalescence of fog and eventually of clouds at any temperature by means of electrified aerosols.] *Académie des Sciences, Paris, Comptes Rendus,* 226(7):587–589, Feb. **1948.** fig., refs. **DLC**—Chart shows time-rate of coalescence of fog under simulated natural conditions as determined from the visibility, the effect of introduction of non-electrified drops (negligible), and the appreciable effect of introduction of electrified drops. (*Same item as* C–153, March 1950, *Met. Abs.*) *Subject Heading:* **1. Artificial fog dissipation.**—*M.R.*

**11M–92** 551.509.617

Pettit, K. G. and Orr., J. L., **Suggested procedure for inducing precipitation from cloud.** *National Research Council of Canada. Low Temperature Laboratory, Laboratory Note,* LT-6-48, July 6, **1948.** 6 p. 2 figs. **DWB**—Details to be followed in dry ice seeding are suggested for the benefit of groups interested in conducting rainmaking experiments. The points discussed are: prerequisite meteorological conditions (cloud identification, limitations), preparation of dry ice, flight technique (seeding pattern, rate of distribution, dispensers) and aircraft requirements. Illustrations show typical cumulus cloud formations and a simple dry ice dispenser. (*Same item as* 6J–13, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with dry ice 2. Cloud seeding techniques.**—*G.T.*

**11M–93** 551.509.617(914)

Philippines. Weather Bureau, **Report on experiment; artificial propagation of rain, February 6, 1948,** by John P. Webber. 3 p. Typescript., photos. (also available in Weather Bureau Library photo collection, No. 804–814), newspaper clippings. **DWB**—Description, by one of the observers, of a cloud seeding experiment carried out with the cooperation of several organizations near Manila. A cumulus cloud was seeded with dry ice from an airplane and yielded precipitation shortly after the seeding had been completed. Development of the cloud during and after the seeding may be well observed on the photographs attached. Clippings from the local press commenting on the event are added. (*Same item as* 6J–14, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with dry ice 2. Cloud seeding in Philippines 3. Manila, Philippine Islands. I. Webber, John P.**—*G.T.*

**11M–94** 551.509.617(772)

Renshaw, Bill, **Can we help it rain? It has been tried in prairie farmer land—with some success.** *Prairie Farmer,* May 8, **1948.** p. 1+. **NSGE**—Popular description of some cloud seeding experiments in Indiana. (*Same item as* C–156, March, 1950, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Indiana 2. Indiana.**

**11M–95** 551.509.617(85)

†*Roldán Seminario, Ernesto, **Notas sobre lluvia artificial.** [Notes on artificial rain.] *Sociedad Geográfica de Lima, Boletín,* 65(3–4):1–79, **1948.** figs., photos, tables (incl. cloud frequency data), 46 refs. **DLC**—A detailed review of the entire field of cloud physics and seeding as reported in the current literature during 1947 and 1948, plus an analysis of cloud and upper air temperature conditions on the coast of Peru. A chronological list of cloud seeding attempts in the U. S. from Nov. 13, 1946 to Oct. 1947 is included. Monthly means and frequencies of cumulus cloud, rainfall, runoff and other data are given *in extenso.* Two unsuccessful attempts at making rain in Peru by cloud seeding are reported. (*Same item as* C–157 and 2.4–43, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding 2. Cumulus cloud data 3. Peru.**—*M.R.*

**11M–96** 551.509.617(44)

Roulleau, J., **La pluie artificielle.** [Artificial rain.] *La Météorologie,* Ser. 4, No. 9:57–65, Jan./March, **1948.** **DWB**—Discussion of precipitation formation theories. Brief report of attempts made in France 1947 by R. Eyraud. (*Same item as* C–158, March 1950, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in France 2. Precipitation formation.**

**11M–97** 551.577.11:551.509.67(94)

Roy, A. K., **Rain-making experiments in Australia; experimental control on the yield of rain from clouds.** *Science and Culture,* 14(5):173–178, Nov. **1948.** 8 figs., 3 tables. **DLC, NSGE**—General review of theories of cloud formation and artificial modification; discussion of Bergeron-Findeisen ice crystal theory of precipitation. Brief report on some of dry ice seeding done in Aus-

tralia. (*Same item as* C–159, March 1950, *Met. Abs.*) *Subject Headings:* **1. Precipitation formation 2. Cloud seeding in Australia 3. Australia.**

**11M–98** 551.509.617

Schaefer, Vincent J., **Experiments with cloudy skies.** *Weatherwise*, Boston, 1(1):3–5, **1948.** illus. **DWB**—Author summarizes first year of activity in the field of cloud modification reviewing basic factors necessary for producing precipitation with dry ice. Partial list is given of experiments conducted in 1946, representative of general advance made in cloud modification. (*Same item as* C–160, March 1950, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding experiments.**

**11M–99** 551.578.41:551.509.617

†Schaefer, Vincent J., **The natural and artificial formation of snow in the atmosphere.** *American Geophysical Union, Transactions*, 29(4):492–498, Aug. **1948.** 4 figs., 19 refs. **DWB**—Description of experiments made in the laboratory and in the natural environment in which small quantities of dry ice have produced enormous quantities of snow from supercooled clouds. Dry ice or any other object colder than about −39°C converts the supercooled water droplets into tiny ice crystals which grow, by vapor exchange, and become snow crystals. Conditions under which such action may be followed by precipitation are discussed. (*Same item as* C–161, March 1950, *Met. Abs.*) *Subject Headings:* **1. Precipitation formation 2. Cloud seeding experiments.**—*Author's abstract.*

**11M–100** 551.509.617:551.578.41

Schaefer, Vincent J., **The production of clouds containing supercooled water droplets or ice crystals under laboratory conditions.** *American Meteorological Society, Bulletin*, 29(4):175–182, April **1948.** 7 figs., refs. **DWB**—Translated into Italian, **La produzione in laboratorio di nubi contenenti goccioline d'acqua soprafusa o cristalli di ghiaccio.** *Rivista di Meteorologia Aeronautica*, 9(1):38 45, Jan./March **1949. DLC**—Detailed description of basic laboratory experiment in which a supercooled cloud may be seeded and converted into ice crystals. Transition temperature at which ice crystals form spontaneously is given as −39°C+0.1°C. Technique for preserving snow crystal structure is described. (*Same item as* C–162, March 1950, *Met. Abs.*) *Subject Headings.* **1. Cloud seeding experiments 2. Ice crystal formation.**

**11M–101** 551.509.617

Schaefer, Vincent J., **The story of man-made weather.** *American Fruit Grower*, March **1948.** p. 17. **DA**—Popular article on artificial cloud modification. (*Same item as* C–163, March 1950, *Met. Abs.*) *Subject Heading:* **1. Artificial precipitation.**

**11M–102** 551.574.1:536.421

Schulz, Gerhard, **Der Einfluss von Fremdkörpern auf die Unterkühlungsfähigkeit des Wassers.** [The effect of foreign substances on the freezing temperature of water.] *Meteorologische Rundschau*, 1(7/8):237–241, Jan./Feb. **1948. DWB**—FINDEISEN succeeded in producing virga artificially from supercooled water clouds (1–9°C) by seeding with the finest powdered sea sand. (For fuller abstract, *see item* 7–86, July 1950, *Met. Abs.*) (*Same item as* 6J–15 and 6F–38, *Met. Abs.*) *Subject Headings:* **1. Supercooled water 2. Freezing nuclei 3. Cloud seeding with sand.**—*M.R.*

**11M–103** 551.509.617:551.509.615(44)

†Schwob, Marcel, **La pluie artificielle et la dissipation locale des brouillards.** [Artificial rain and local fog dispersal.] *Office National d'Etudes et de Recherches Aeronautiques, Paris, Publication*, No. 10, **1948.** 24 p. **DLC.** (Unchecked in original.) Translation by D. A. Sinclair, issued as *National Research Council of Canada, Technical Translation* No. TT-87, April 20, **1949.** 30 p. 41 figs., 21+6 refs.—Review of physical phenomena and meteorological basis for modification of clouds. Appraisal of American research. Description of French contributions. (*Same item as* C 164, March 1950, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Artificial fog dissipation 3. France.**

**11M–104** 551.509.617(68)

South African Council for Scientific and Industrial Research, Pretoria, **Artificial stimulation of precipitation.** Interim progress report on experiments carried out by the Council for Scientific and Industrial Research, Division of Meteorology and the South African Air Force, Dec. 1947 to April 1948. Pretoria, **1948.** 20 p. 2 plates, charts, graphs, tables. **DWB**—The object and design, arrangements and equipment, of experiments in artificial stimulation of precipitation by cloud seeding in South Africa. Records kept. Conclusions drawn. (*Same item as* C–165, March 1950, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in South Africa 2. South Africa.**

**11M–105** 551.509.617(611)

Tixeront, J., **Les essais de pluie provoquée en Tunisie.** [Attempts to induce rain in Tunisia.] *Bulletin Economique et Social de la Tunisie*, No. 22:55–59, Nov. **1948.** table. **DLC**—The history and results of experiments are presented by the chief engineer of the Hydrological and Rural Management Section. The study of BERGERON'S theory resulted in the joint effort of various French and Tunisian authorities to launch experiments. Results of ten experiments carried out in 1948 are reported in a table showing date, aircraft, altitude of cloud, distance between seeding point and point of rainfall at the soil and its center, surface covered by rain, quantity of water received, the chemical used, and notes on effects. An evaluation of the table is presented. Detailed study of observations, continuation of experiments, and elimination of errors are suggested. *Subject Headings:* **1. Cloud seeding in Tunisia 2. Tunisia, Africa.**—*O.T.*

**11M–106** 551.509.617

United States Congress, House. Committee on Interstate and Foreign Commerce, **Rainfall experiments.** Hearing, 80th Congress, second session on H.R. 4582; a bill to direct the chief of the U. S. Weather Bureau to conduct experiments with respect to methods of controlling rainfall. March 18, 1948. Washington, D. C., **1948.** 40 p. **DLC**—This report contains a broad survey of artificial precipitation research and problems, as well as the text of a bill, reports from government agencies, statements and letters from scientists involved in cloud physics research etc. (*Same item as* C–166, March 1950, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Weather control legislation.**

**11M–107** 551.578.41:551.574.1:551.509.617

Vonnegut, Bernard, **Production of ice crystals by the adiabatic expansion of gas.** Also: **Nucleation of supercooled waterclouds by silver iodide smokes.** And **Influence of butyl alcohol on shape of snow crystals formed in the laboratory.** *General Electric Research Laboratory, Schenectady, Occasional Report* No. 5 on Project Cirrus, July 15, **1948.** 12 p. 6 figs., refs., 9 eqs. **DWB**—Measurements carried out on the nucleation of supercooled water clouds by silver iodide smokes. Found that silver iodide particles do not react immediately to form ice crystals when they are put into a supercooled cloud; crystals still form 50 minutes after silver iodide is introduced. Rate of reaction at −13°C interpreted to be 30 or 40 times that −10°C. (*Same item as* C–167, March 1950, *Met. Abs.*) *Subject Headings:* **1. Ice crystal formation 2. Cloud seeding with silver iodide.**

**11M–108** 551.509.617(437)

**Komise pro studium umělého deště.** [Research Committee on Artificial Rainfall.] *Meteorologické Zprávy*, Prague, 1(6):152, **1947**; 2(2):52, **1948.** **DLC**—Brief accounts of the first to fifth meetings (Jan. 8 to May 20, 1948) of the Czechoslovak Committee for cloud seeding research consisting of 15 members headed by M. KONČEK. Subcommittees were formed for laboratory studies, aerological research, field experiments and literature survey. Tests with two different (unidentified) powders were carried out on May 14 with negative result. (*Same item as* 6J–348, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Czechoslovakia 2. Czechoslovakia.** —*G.T.*

**11M–109** 551.578.1:551.509.617

**Meteorological Office discussion of Langmuir's paper, "Production of rain by chain reaction in cumulus clouds at temperatures above freezing."** *Meteorological Magazine*, London, 77(918):278–280, **1948.** **DWB**—LANGMUIR'S paper (see 11M–88) was presented and reviewed by RONALD FRITH and discussed pro and con by British meteorologists: JOHNSON, ABSALOM, LUDLAM, SCRASE and SUTCLIFFE. (*Same item as* C–152, March 1950, *Met. Abs.*) *Subject Headings:* **1. Langmuir's theory 2. Precipitation formation.**

**11M–110** 551.509.61

**Weather under control.** *Fortune*, N. Y., 37:106–111, 128–137, 14 illus., Feb. **1948.** Comment by F. W. Reichelderfer, *ibid.*, 37:38, March **1948.** **DLC**—Langmuir's and Schaefer's experiments are appraised. Frequency of supercooled fogs and clouds at Mount Washington Observatory impressed them toward their research program at Schenectady. Schaefer discovered −39°C as the critical temperature for producing ice crystals. The Findeisen-Bergeron theory is explained. Dry ice, silver iodide and water seeding effects are shown among the illustrations. Project Cirrus and the Weather Bureau and Air Force Cloud Physics study is reviewed. Houghton, Rosby and John von Neumann's part in further development is mentioned. Reichelderfer's comment warns on widespread weather control possibilities. *Subject Heading:* **1. Cloud seeding. I. Reichelderfer, F. W.**—*O.T.*

1949

**11M–111** 551.509.617

Aujeszky, László, **A mesterséges esökeltés kérdésének mai állása.** [The problem of artificial rain stimulation.] *Időjárás*, Budapest, 53(3–4):89–98, March–April **1949.** 11 refs. English summary p. 155. **DWB**—An analysis of known experiments and likely prospects of artificial rain production. (*Same item as* C–182, March 1950, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding.**—*Author's abstract.*

**11M–112** 551.509.6:34

†Ball, Vaughn C., **Shaping the law of weather control.** *Yale Law Journal*, 58(2):213–244, Jan. **1949.** refs. **DLC**—After a competent review of progress in weather modification and of its possible applications, the author examines the possibility of weather modification activities giving rise to criminal or civil action on the basis of (a) claims for personal injury and property damage and (b) claims of property rights in the weather. The author suggests that until the problems connected with weather modification are cleared up, only the federal government, its contractors, and state and local governments acting in cooperation with it should be allowed to conduct weather control experiments. Legislative action started with a view to regulating such government activity is discussed. Ample reference to both scientific and legal literature and documents is given. (*Same item as* 6J–6, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Weather control legislation 2. Legal aspects of weather control.**—*G.T.*

**11M–113** 551.509.617

Banerji, S. K., **Suggested procedure for inducing precipitation from clouds.** *India. Central Board of Irrigation, Journal*, 6(2):175–176, April **1949.** fig. **DA** (55.9In222C)—The probability of successful operations is analyzed on the basis of prerequisite meteorological conditions including cloud identification and cloud limitations. The technique of preparation of dry ice, its crushing and handling are described as well as is the flight technique with the seeding pattern. Aircraft requirements are suggested. *Subject Heading:* **1. Cloud seeding with dry ice.**—*O.T.*

**11M–114** 551.509.617(68)

B[annon], J. K., **South African rain-making experiments.** *Weather*, 4(5):155, **1949. DWB**—Brief report on dry ice and water seeding during the summer of 1947–1948. (*Same item as* C–170, March 1950, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in South Africa 2. South Africa.**

**11M–115** 551.509.617(8–6)

Basauri, D., **La lluvia artificial en Centro America.** [Artificial precipitation in Central America.] *Café de El Salvador*, San Salvador, 19(216):1357, April **1949. DA** (68.28C112). Also in *Café de Nicaragua*, Managua, 5(56/57):11 15, July/Aug. **1949. DA** (68.28C114)—The fertilizing function of rain by its various mineral solutions is discussed from the point of view of coffee plantations. Experiments with artificial rain in Australia, the United States (Richmond and Chicago), and Bavaria and the various methods are described. Preliminary activities in Central America, as those of the Ministry of Agriculture of El Salvador; the Asociación Cafetalera de El Salvador; the Compañía del Cafe; and the Federación Cafetalera Centro-América-México, are reviewed. *Subject Headings:* **1. Artificial precipitation 2. Cloud seeding with dry ice 3. Central America.**—*O.T.*

**11M–116** 551.509.617:551.577

Bergeron, Tor, **Nyare rön om nederbördens uppkomst och fördelning.** [Recent developments in the study of the formation and distribution of precipitation.] *Ymer*, Stockholm, 3:161–188, Sept. **1949.** 24 figs., 13 refs. English summary p. 185–187. **DLC, DWB**—The orographic effects on moisture-laden winds are discussed, leading to the theory that rainfall might be decreased on the windward slopes and be caused to fall by natural processes in the leeward region (as in Sweden) by *overseeding* of clouds with silver iodide on the coasts of Norway. (*Same item as* 6J–17, Oct. 1955, *Met. Abs.*) (For fulier abstract, *see item* 10–44, Oct. 1950, *Met.Abs.*) *Subject Headings:* **1. Cloud seeding with silver iodide 2. Overseeding.**—*M.R.*

**11M–117** 551.509.617

Bergeron, Tor, **The problem of artificial control of rainfall on the globe, Pt. 1, General effects of ice-nuclei in clouds.** *Tellus*, 1(1):32–43, Feb. **1949.** 10 figs., 23 refs. **Pt. 2, The coastal orographic maxima of precipitation in autumn and winter.** *Ibid.*, 1(3):15–32, Aug. **1949.** 10 figs., table, 10 refs. **DWB**—In Pt. 1, the author goes into the details of the theory of cloud structure and physics as developed by Wegener, Findeisen and himself, and brings the theory up to date in the light of recent experiments on artificial condensation conducted in the U. S., Hawaii and Australia by Schaefer, Leopold, Kraus and others. The conditions under which colloidal or thermodynamic

stability or instability would result, from natural or artificial stimuli, are described and illustrated. The mechanics of producing stabilizing effects by "over-seeding" is discussed. He considers the ideal optimum amount to be ($v = 10^3$) for "trigger" action. In Pt. 2, the author describes winter precipitation (snow or rain) along flat coasts and steep slopes with examples from Sweden, Norway and Holland. Three different frictional effects leading to maximum precipitation in coastal areas, and possible secondary maxima farther inlands are noted. It is shown that the conditions ideal for getting the maximum effect by seeding are those when there is already an abundance of precipitation and by so doing the drier inland areas would be robbed of moisture. A better scheme would be to "over-seed" clouds in certain areas and certain times to stabilize them and prevent release of moisture or produce a steady and non-violent release. (*Same item as* C–168, 169, March 1950, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Condensation nuclei.**

**11M–118** 551.509.617(44,61)

Calvet, Emile, **La pluie artificielle.** [Artificial rain.] *France. Centre de Recherches et d'Expérimentation du Génie Rural, Études et Travaux*, No. 9, **1949.** 56 p. **DA**—In addition to a detailed discussion of natural and artificial rain formation mechanisms and of results in artificial precipitation obtained in various countries, this paper contains a description of cloud seeding experiments undertaken in France. In 1947–1948 EYRAUD made successful experiments with dry ice. In North Africa some results were achieved with water, dry ice and silver iodide in 1948 and 1949. Possible benefits to be derived from artificial rainfall are elaborated on. (*Same item as* 6J–18, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in France 2. Cloud seeding in North Africa 3. France 4. North Africa.**—*G.T.*

**11M–119** 551.509.617(771)

*Coons, Richard D.; Jones, Earl L. and Gunn, Ross, **Second partial report on the artificial production of precipitation: cumuliform clouds, Ohio, 1948.** *U. S. Weather Bureau, Research Paper* No. 31, Jan. **1949.** 58 p. 28 figs., charts, 4 tables, 3 refs. **DWB**—Summary report of this paper in: *American Meteorological Society, Bulletin*, 29(10):544–546, Dec. **1948.** 3 tables, 5 refs. **DWB**—Procedure of seeding and observations reported, including tables, adiabatic charts, radar scopes, photographs of clouds, etc. It was shown that artificial modification of cumuliform clouds is of doubtful economic importance in producing rain. Dissipation rather than new development was the general rule. Methods were not considered promising for relief of drought. (*Same item as* C–171, March 1950, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding in Ohio.**

**11M–120** 551.509.617(794)

Coons, Richard D.; Jones, Earl L. and Gunn, Ross, **Third partial report on the artificial production of precipitation: orographic stratoform clouds—California, 1949.** *U. S. Weather Bureau, Research Paper* No. 33, **1949.** 14 p. 7 figs., table, 3 refs. **DWB**—This phase of the Cloud Physics Project concerns artificial modification of orographic type clouds and of clouds in different climatic areas. Complete description is given of each of the seedings and atmospheric soundings for each day. Results followed those of earlier missions. The natural water cloud dissipated in the immediate vicinity of the seeded area while the ice crystal structure of the seeded area remained little affected. Table indicates correlation between divergence field as calculated by Bellamy's method and the opening of holes in the cloud deck by seeding. Seeding is capable of dissipating clouds when horizontal divergence exists. (*Same item as* C–172, March 1950, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding in California.**

**11M–121** 551.508.85:551.509.617

*Coons, Richard D.; Jones, Earl L. and Gunn, Ross, **Fourth partial report on artificial production of precipitation: cumulus clouds, Gulf States, 1949.** *American Meteorological Society, Bulletin*, 30(8):289–292, Oct. **1949.** 3 tables, 4 refs. **DWB.** Also issued in *U. S. Weather Bureau Research Paper* No. 33, p. 15–45, **1949.** 28 figs., 2 tables, 2 refs. **DWB**—A paper dealing with the 44 seedings into 39 cumulus clouds made during May and June 1949. The results are presented in tables. Airborne and ground radar was used to check conditions of clouds and development. (*Same item as* C–173, and 2H–31, *Met. Abs.*) *Subject Headings:* **1. Radar equipment 2. Radar observation 3. Cumulus clouds 4. Artificial precipitation.**

**11M–122** 551.509.617

Contreras Arias, Alfonso, **La verdad respecto de la "lluvia artificial."** [The truth about artificial precipitation.] *Tierra*, Mexico City, 4:420–423, 490–493, July, Aug. **1949. DA** (8 T445). Also in *Chapingo*, Mexico City, 3(28, 29):212, 215, 240–244, 4 illus., April, May **1949, DA** (102 C36)—EDWIN J. HOUSTON of the Franklin Institute in Phil. created a scientific basis for artificial precipitation in 1891, through his theory of convection. With his research on cloud physics T. BERGERON

paved the way for hail control and artificial precipitation by dry ice seeding. Research by the meteorological services of the U. S., Canada and Mexico is reviewed in connection with dry ice seeding experiments, including those at Hawaii in 1947. Silver iodide seedings had similar results. The claimed results, however, are insignificant yet. *Subject Heading:* **1. History of cloud seeding.** —*O.T.*

**11M–123** 551.574.1:551.509.617(931)

Cwilong, B. M., **Sublimation in outdoor air and seeded sublimation.** *Nature*, London, 163:727–728, May 7, **1949.** 4 refs. **DLC**—Tendency of silver iodide to initiate the sublimation of water vapor was tested in an expansion chamber. (*Same item as* C–175, March 1950, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with silver iodide 2. Sublimation nuclei.**

**11M–124** 551.509.617

*Fraser, D., **Induced precipitation—preliminary experiments on seeding a variety of clouds with dry ice.** *National Research Council of Canada.* Div. of Mechanical Engineering. *Report* MR-4, Jan. 18, **1949.** 14 p. 5 figs., 2 tables. **DWB**—A number of dry ice seeding runs were made above and below freezing level, over cumulus- and stratus-type clouds and in clear air. It appeared that precipitation could be produced from clouds if part of the cloud was supercooled; cloud modification of an unpredictable type could be produced; under some conditions clouds could be generated in clear air. Photographs were taken at time of seeding and afterwards. (*Same item as* C–176, March 1950, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding with dry ice.**—*From author's abstract.*

**11M–125** 551.509.617(71)

Fraser, D., **Production of ice-crystal clouds by seeding.** *Nature*, London, 164:179–180, July 30, **1949.** 2 refs. **DWB**—Air supersaturated with respect to ice but not as to water was seeded with dry ice in some Canadian experiments. Photographs taken have allowed preliminary studies of the growth of generated crystals and comparison with crystals in adjacent natural clouds. Preliminary tests on rate of seeding, size of granules and other variables were made. (*Same item as* C–177, March 1950, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding.**

**11M–126** 551.509.617

Garrigue, H., **Sur le déclenchement artificiel de la pluie.** [The artificial release of rain.] *Académie des Sciences, Paris, Comptes Rendus*, 228(21):1658–1659, **1949.** 2 refs. **DLC**—Influence of turbulence on the coagulation of fog is considered. (*Same item as* C–178, March 1950, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Turbulence 3. Fog.**

**11M–127** 551.509.617(82)

Georgii, Walter, **Teoria de cambio de fases del agua y su aplicación en el problema de la lluvia artificial.** [Theory of the change of phase of water and its application to the problem of artificial precipitation.] *Sociedad Científica Argentina, Anales*, 148(6):343–364, Dec. **1949. DLC, DWB**—An exposition of new ideas about the principal theories which govern the change of phase of water according to the works of VOLLMER and the experimental research carried on in Germany, especially on the action of freezing nuclei. The author examines the basic requirements for the formation of precipitation and their possible application in Argentina making use of the formation of stationary cumulus characteristic of the Sierras of Cordoba and San Luis and in the Cordillera of the Andes. (*Same item as* 3C–174, March 1952, *Met. Abs.*) *Subject Headings:* **1. Precipitation physics 2. Argentina.**—*C.N.M.*

**11M–128** 551.509.617(791)

Hoff, Amos H., **Lluvia provocada artificialmente.** [Artificially induced rainfall.] *Sociedad Mexicana de Geografía y Estadística, Mexico City, Boletín*, 67(1):195–204, Jan./Feb. **1949. DLC**—Mechanisms by which ice crystals introduced into a cloud disturb the cloud's colloidal stability are discussed in some detail. Dry ice seedings from the air, conducted by the author over Phoenix, Arizona, are described in general terms. Several of the seeding operations are reported to have been successful. (*Same item as* 6J–19, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with dry ice 2. Arizona.**—*G.T.*

**11M–129** 551.509.617

Koldovský, Milan, **Umělé uvolňování srážek.** [Artificial release of precipitation.] *Meteorologické Zpravy*, Prague, 3(6):94–96, **1949.** 3 refs. **DLC**—The BERGEON-FINDEISEN theory of precipitation formation and LANGMUIR'S chain reaction theory of artificial nucleation are reviewed. Relative suitability of various cloud types for artificial precipitation is discussed. The author concludes that cloud seeding, in order to be effective, must be extensive and persistent, and will

therefore probably be found uneconomical and impractical. (*Same item as* 6J–349, Oct. 1955, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding.**—*G.T.*

**11M–130** 551.509.617(791)

Krick, Irving P., **Evaluation of cloud seeding operations in the Phoenix area during the winter and spring of 1949.** Prepared for the Arizona Weather Research Foundation. Sept. **1949.** 80 p. 23 figs., 18 tables, 4 refs. Mimeo.—Report covers aerial and ground cloud seeding operations. Each aerial seeding day is described in detail with flight times and paths. General weather situation is given and resultant precipitation pattern for each day. Development and use of ground seeding equipment, location of field units, and details of daily operations, are included. Means are described for determining the effects of seeding operations. All evaluations of seeding operations, aerial and ground, appear to be positive. (*Same item as* C–180, March 1950, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Arizona 2. Arizona.**

**11M–131** 551.509.617:551.578.41

*Langmuir, Irving, **Study of the effects produced by the dry ice seeding of stratus clouds.** *General Electric Research Laboratory, Schenectady, Occasional Report on Project Cirrus*, No. 10, Feb. **1949.** (Also published in Final Report on Project Cirrus, Dec. 31, **1948.** p. 121–135.) fig., 8 photos, 4 tables, 24 equations. **DWB**—A dry ice cloud seeding flight is described. Information on the rate of propagation of the ice crystal cloud is correlated with meteorological conditions at the time. Effects produced on temperature and turbulence with a stratus cloud by seeding are considered, as well as rate of growth of snow crystals in air saturated with respect to water. Propagation of ice nuclei in stratus clouds and the effect of stability in cloud layers are discussed. (*Same item as* C–181, March 1950, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with dry ice 2. Ice crystal formation.**

**11M–132** 551.509.617(71)

*Orr, John L.; Fraser, D. and Petit, K. G., **Analysis of experiments on inducing precipitation.** *National Research Council of Canada, Report* No. MD-32, Aug. 17, **1949.** fig., tables, refs. Also their: **Canadian experiments on artificially inducing precipitation.** *American Meteorological Society, Bulletin*, 31(2):56–59, Feb. **1950.** 8 tables, ref. Also: Orr, J. L., **Canadian experiments on induced precipitation.** (In: United Nations Scientific Conference on the Conservation and Utilization of Resources, Lake Success, N. Y. **1949, Proceedings, v. 4, Water Resources,** p. 27–36, **1951.** 7 figs., 9 tables, 13 refs.) **DWB**—Fifty-nine trials have been made using dry ice. In most cases the structure of clouds was altered, in many cases precipitation was produced, and under certain conditions clouds were generated. (For fuller abstracts, *see items* C–204, 4.2–75 and 4.4–79, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Canada 2. Cloud seeding with dry ice 3. Canada.**—*A.A.*

**11M–133** 551.509.617(71)

†Perrie, D. W., **Cloud seeding experiments, November 1948.** *Canada. Meteorological Div., Circular*, 1554, **1949.** 12 p. tables and summary of induced precipitation. **DWB**—Results of a series of cloud-seedings near Abitibi Lake, Canada. Procedures described, records kept. Use of seeding for dissipation considered more significant than for precipitation. (*Same item as* C–183, March 1950, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Canada 2. Canada.**

**11M–134** 551.509.617(71)

†Perrie, D. W., **Precipitation release.** *Canada. Meteorological Div., Circular* 1557, Jan. **1949.** table, 11 refs. **DWB**—Paper read at Canadian Association of Physicists, Ottawa, May 1948, as part of a symposium on cloud physics. A summary of theoretical background and discussion of theories of artificial precipitation are given. (*Same item as* C–184, March 1950, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Canada 2. Precipitation formation.**

**11M–135** 551.509.617:551.578.7(44)

Ruby, Frederic-Leon, **Rapport général sur la défense contre la grêle en France, 1947 (and) 1948.** [General report on hail control activities in France, 1947 and 1948.] *Lyon. Centre National de Défense Contre la Grêle*, [*Rapport Général*], 1947, 1948, (pub. **1948?** and **1949?**). 61 and 69 p. maps. **DA**—Hail control activities in France in 1947 and 1948 are discussed according to administrative regions. Hail control networks and their operations are described in detail and illustrated on maps. The operations were carried out by means of explosive rockets. Qualitative results are indicated. (*Same item as* 6J 21, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Hail prevention in France 2. France.**—*G.T.*

**11M–136** 551.509.617(791)

Stimson, E., Jr. and Krick, Irving P., **Want to buy some rain?** *Popular Mechanics*, Chicago, 91:130–133, 266, 268, 270, 272, March **1949.** 9 figs. **DLC**—Air Force and Weather Bureau had

negative results in numerous attempts to stimulate rainfall over an 8 by 20 mile test area in Ohio in 1948. The Weather Research Foundation claimed to have produced 12,000 acre-feet of water in excess of possible natural rainfall over the Salt River, Verde River and Tonto Creek watersheds, Arizona, in 1948. The contradiction is explained by different weather and other conditions. The Bergeron-Findeisen theory and General Electric's dry-ice research are reviewed. This history of the Arizona experiments is described. The cost of between $2.00 to 2.50 per acre-foot is satisfactory from an economic standpoint. Among the illustrations is a sketch of a double-seeding performance dumping dry ice from above and silver iodide from below into a cumulus cloud, a map of the location of the Arizona seeding, a diagram of the estimated runoff produced by rainmaking flights, a sketch showing the seeding and observation legs of a flying operation, and photographs of equipments. *Subject Headings:* **1. Cloud seeding in Arizona 2. Cloud seeding experiments 3. Arizona.**—*O.T.*

**11M–137** 551.574.1:551.509.617

Schaefer, Vincent J., **The formation of ice crystals in the laboratory and the atmosphere.** *Chemical Reviews*, Baltimore, 44(2):291–320, April **1949.** 22 figs., 5 tables, 20 refs. **DLC**—Summary of author's laboratory and field activities in experimental meteorology. Properties of snow particles and electrical characteristics are discussed. Techniques for detecting sublimation nuclei in the free atmosphere are given, involving cold chamber and supercooled films. Description of technique and procedure used in simulating natural clouds. Role of dust particles as sublimation nuclei. Effect on the crystal habit of ice produced by the blocking action of adsorbed surface active polar molecules is shown. Some aspects of the cloud modification studies initiated by the author in 1946 are described, with some observed results and discussion of relationships believed to exist in unstable clouds. (*Same item as* 6H–174, Aug. 1955, *Met. Abs.*) *Subject Headings:* **1. Ice crystal formation 2. Sublimation nuclei 3. Cloud seeding.**

**11M–138** 551.509.617:551.515.4(78)

Schaefer, Vincent J., **The possibilities of modifying lightning storms in the Northern Rockies.** *U. S. Forest Service, Northern Rocky Mountain Forest and Range Experiment Station, Missoula, Montana, Station Paper* No. 19, Jan. **1949.** 18 p., 5 refs. **DWB**—The author spent several weeks in the summer of 1948 studying and photographing cumulus clouds near Priest Lake, Idaho, with the object of testing the possibility of modifying thunderstorms which cause so many fires in the Northern Rockies. This report describes his activities and recommendations for an observation and cloud seeding program in this region. Unfortunately there were few storms during the month he spent at Priest Lake, and none of them presented ideal conditions for test and control. This report could serve as a guide for any organization attempting to inaugurate a program of seeding for production of artificial precipitation or cloud dissipation. (*Same item as* 1–110 and C–186, *Met. Abs.*) *Subject Heading:* **1. Thunderstorm suppression.**

**11M–139** 551.576.11:551.509.617(729.5)

Schaefer, Vincent J., **Report on cloud studies in Puerto Rico.** *General Electric Research Laboratory, Schenectady, Occasional Report on Project Cirrus*, No. 12, April **1949.** 16 p. **DWB**—The purpose of this operation was to determine type and physical characteristic of clouds that occur in Puerto Rico during winter months, and to develop and, if possible, to evaluate water seeding techniques. Operations are described. One of the results was development of a technique for sampling rain in and under a cloud. (*Same item as* C–188, March 1950, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with water 2. Cloud structure 3. Puerto Rico.**

**11M–140** 551.509.617(94)

Smith, E. J., **Experiments in seeding cumuliform cloud layers with dry ice.** *Australian Journal of Scientific Research, Ser. A, Physical Sciences*, 2(1):78–91, March **1949.** 7 figs., 14 plates, table, 4 refs. **DLC**—Five experiments are described in which dry ice was dropped into supercooled cumulus clouds. Precipitation of snow or ice crystals occurred, and part or all of the cloud dispersed. Displays of haloes and similar phenomena were observed. Article contains adiabatic charts, data for different soundings, photographs of clouds during seeding experiments. (*Same item as* C–189, March 1950, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with dry ice 2. Australia.**—*From author's abstract.*

**11M–141** 551.509.617(94)

Squires, P. and Smith, E. J., **The artificial stimulation of precipitation by means of dry ice.** *Australian Journal of Scientific Research, Ser. A., Physical Sciences*, 2(2):232–245, June **1949.** 2 figs., 2 tables, 6 refs. **DLC**—Dry ice seeding experiments near Sydney in supercooled clouds are described. Genuine positive effects are observed. Observations are consistent with the view that the precipitation grew from ice crystals (formed by dry ice pellets), in accordance with theory of Bergeron.

(*Same item as* C-190, March 1950, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with dry ice 2. Australia.**

**11M-142** 551.509.617:551.578.7(494.5)

Staub, H.; Thams, I. C. and Zenone, E., **Die Organisation des Grossversuches zur Bekämpfung des Hagels in der Magadino-Ebene.** [Organization of a large scale project to control hailstorms in the Magadino Plain.] *Schweizerische Landwirtschaftliche Zeitschrift*, Zürich, No. 41:1113-1124, Oct. 14, 1949. 5 figs. **DA**—An elaborate hail warning system was set up in the rich mountain valley above Locarno, and attempts at control of hailstorms by rockets (hail shooting) described and illustrated. Comprehensive reports of weather conditions, shooting and effectiveness (damage as estimated by the Swiss Hail Insurance Society) are made each time. Results inconclusive as yet. (*Same item as* 8-30 and 6J-22, *Met. Abs.*) *Subject Headings:* **1. Hail shooting 2. Hail prevention in Switzerland 3. Hail warning networks 4. Magadino Plain, Switzerland.**—*M.R.*

**11M-143** 551.574.1:551.509.617

Vonnegut, Bernard, **Nucleation of supercooled water clouds by silver iodide smokes.** *Chemical Reviews*, 44(2):277-289, April 1949. 6 figs., 5 refs., 9 eqs. **DLC**—Measurements carried out in a cold box on the nucleation of ice in supercooled clouds by silver iodide smoke particles show that ice crystals do not form immediately on these particles. Silver iodide can be regarded as greatly increasing the probability of ice crystal formation. The number of effective ice nuclei which can be produced per gram of silver iodide varies with temperature. (*Same item as* C-192, March 1950, *Met. Abs.*) *Subject Headings:* **1. Silver iodide nucleation 2. Sublimation nuclei 3. Cloud chamber experiments.**

**11M-144** 551.509.617

Vonnegut, Bernard, **Silver iodide smoke.** *General Electric Research Laboratory, Schenectady, Occasional Report on Project Cirrus*, No. 13, July 1, 1949. 29 p. 19 figs., 8 refs. **DWB**—Construction and operation of silver iodide smoke generators are described. Preliminary experiments are conducted in seeding natural clouds with silver iodide. Most of them were inconclusive, but one time about 6 square miles of supercooled cloud layer were transformed into ice crystals as the result of seeding with less than an ounce of silver iodide. Photographs made. (*Same item as* C-193, March 1950, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with silver iodide 2. Silver iodide smoke generators.**

**11M-145** 551.509.617

Ward, Chester, **Weather or not—the Navy may pay for rain.** *JAG*, (Journal of the Judge Advocate General of the Navy), p. 2-8, Oct. 1949. **DWB**—Legal problems of rainmaking are discussed. (*Same item as* C-194, March 1950, *Met. Abs.*) *Subject Heading:* **1. Legal aspects of weather modification.**

**11M-146** 551.509.617(728.2)

**Honduras rustlers in the sky.** *Time*, 54(7):27, Aug. 15, 1949. **DLC**—Brief popular article describing successful dry ice seeding for rainmaking by the United Fruit Co. over Sula Valley, Honduras. (*Same item as* C-179, March 1950, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Honduras 2. Honduras**

**11M-147** 551.509.617:551.515.4

**Thunderstorm control in U. S. A.** *Weather*, London, 4(5):152-153, 1949. **DWB**—Short item on SCHAEFER's theory to reduce or inhibit thunderstorm activity by seeding with dry ice. (*Same item as* C-191, March 1950, *Met. Abs.*) *Subject Heading:* **1. Thunderstorm suppression.**

**11M-148** 551.509.617:34

**Who owns the clouds?** *Stanford Law Review*, 1(1):43-63, Nov. 1948. refs. Also: **Artificial rainmaking.** *Ibid.*, 1(3):508-537, April 1949. refs. **DLC**—These papers on weather modification (the second being a continuation of the first) contain a detailed discussion of the various legal principles involved in rights of ownership and use of the water in clouds, federal and state powers to regulate rainmaking, liability for damage caused by rainmaking, etc. A brief summary (with references) of the early history of rainmaking will also be found here. (*Same item as* 6J-23, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Legal aspects of weather modification 2. Artificial precipitation.**—*G.T.*

**11M-149** 551.509.617

**Would curb rain-makers.** *Science Digest*, 25(5):93, May 1949. **DLC**—Brief article describing article in Yale Law Journal proposing a law to prevent irresponsible rainmaking. (*Same item as* C-195, March 1950, *Met. Abs.*) *Subject Heading:* **1. Weather control legislation.**

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**11M–150** 551.509.617(794)

†Anderson, Charles E., **Evaluation of results of joint Air Force—Weather Bureau cloud seeding trials conducted during winter and spring 1949.** *U. S. Air Force. Cambridge Research Laboratories, Geophysical Research Papers*, No. 4, May **1950.** 30 p. 4 figs., 4 tables, 35 refs., 3 eqs. **DWB**—Discussion of the theory and application of dry ice seeding to cloud dissipation, cloud formation or precipitation inducement. The tests (48 trials) conducted for this project did not give encouraging results as far as initiating heavy precipitation from cumulus congestus clouds is concerned. Virga was produced from supercooled cumulus on several occasions. Partial dissipation of cloud occurred in 100% of the trials. (*Same item as* 6J–24 and 2.1–57, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with dry ice 2. California 3. Mobile, Alabama.**—*M.R.*

**11M–151** 551.509.617

Angell, George N., **Rain making; hot Wheat League topic.** *Oregon Farmer*, Portland, 73:892, 899, Dec. 21, **1950.** fig. **DA** (6 Or32)—A report on IRVING P. KRICK'S address at the organization's national convention on the achievements of artificial rain. A sketch illustrates how cloud seeding by silver-iodide crystals works. *Subject Heading:* **1. Cloud seeding with silver iodide.**—*O.T.*

**11M–152** 551.509.617(791)

Avery, Ben., **Rain making in Arizona.** *Reclamation Era*, Wash., D. C., 36(5):89–90, May **1950.** 2 figs. **DA**—IRVING P. KRICK'S successful experiments in the Salt River Valley between 1947 and 1950 are described. Sodium oxide seeding is illustrated. *Subject Headings:* **1. Cloud seeding with sodium oxide 2. Arizona.**—*O.T.*

**11M–153** 551.509.617:551.574.1(540)

Banerji, S. K., **Rain-making. The 12th Acharya Jagadish Chandra Bose Memorial Lecture, with Director's Report presented to the 33rd Anniversary meeting of the Bose Institute, Nov. 30, 1950.** Prabasi Press, **1950.** 29 p. 3 figs., tables. Summary in *Journal of Scientific and Industrial Research*, 10(1):35, Jan. **1951. DWB**—The author deals with the physics of drop growth and rain formation, evaporation, the condensation theory of rain drop growth, BERGERON'S theory involving the formation of ice crystals on supercooling, LANGMUIR'S work on the growth of cloud droplets by accretion, and FINDEISEN'S work on the production of ice-forming nuclei during the sublimation of water vapor on to a growing crystal. The use of dry ice cloud seeding to produce rainfall, the experiments on artificial seedings carried out in Australia, Hawaii and South Africa, the best position in the cloud for seeding to obtain optimum results, the effect of seeding on the track of cyclonic storms and the importance of artificial rain in India are discussed. (*Same item as* 6.6–128 and 6J–25, 1955, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Cloud seeding in India 3. Cloud physics 4. India.**—*I.L.D.*

**11M–154** 551.509.617

Barla, Mario, **Esperimenti di pioggia artificiale.** [Experiments in artificial rainfall.] *Cronache Economiche*, Torino, No. 83:17–18, June 15, **1950.** 2 figs., table. **DA** (280.8C882)—Various experiments, starting with those of VINCENT SCHAEFER at Schenectady in November 1946, are discussed. Hail control and artificial precipitation projects in Italy are described. Photographs illustrate the use of helicopters in Arizona. The amount of water vapor at 0 to 25°C temperatures is shown in a table. *Subject Heading:* **1. Cloud seeding experiments.**—*O.T.*

**11M–155** 551.578.7:551.509.617(494.5)

Bider, M., **Versuche zur Hagelbekämpfung.** [Attempts at hail control.] *Leben und Umwelt*, Basel, 6(12):273–279, Sept. **1950. DWB**—The author discusses the problem of cloud dispersion by exploding rockets. The problem figured on the agenda of an international conference at Graz in 1902. Experiments were made in 1935 in Beaujolais, France, with success claimed by participants. Similar experiments have been in progress in the Magadino Plain, Tessin, Switzerland, since 1948. Forty-eight operators armed with special rockets, whose altitudinal ranges are 600 and 1200 m, are in continuous readiness for hailstorm warnings. They prepare detailed records of rockets fired and of the synoptic situation at the time. The experimental project will be carried on for 5 years. The author finds no possible physical explanation for ultimate effectiveness of the method. He also mentions cloud seeding as a possible alternative but reserves his final opinion on the subject. Storm clouds in the Magadino Plain and a rocket about to be fired are shown in photographs. (*Same item as* 3.11–86 and 6J 26, *Met. Abs.*) *Subject Headings:* **1. Hail prevention in France 2. Hail prevention in Switzerland 3. Hail shooting 4. Magadino Plain, Switzerland.**—*G.T.*

**11M–156** 551.578.7:551.509.617(45)

Bossolasco, Mario, **L'ignoranza della meteorologia come mezzo di difesa utopistica contro la grandine.** [Ignorance in meteorology as a means of utopistic hail control.] *Notizario sulle Malattie delle Piante*, No. 9:32–33, March/April **1950.** Also: Rui, Dino, **L'ignoranza dei fatti come probabile modo per spiegare una nota.** [Ignorance of the facts as a likely explanation for a note.] *Ibid.*, p. 33–36. Reply by both authors, p. 57. **DA** (464.8N84)—Prof. Bossolasco in a sharp manner attacks General Ruby's hail control experiments as being contrary to all scientific theories, lacking professional support and wasting expenses. Dino Rui replying in Ruby's defense, emphasizes the still controversial meteorological theories and the Swiss experiments based on similar principles. Both authors' replies confirm their original standpoints. *Subject Headings:* **1. Hail control 2. Italy.**—*O.T.*

**11M–157** 551.509.617(74)

Brooks, Charles F., **Will New York rainmaking affect New England rainfall?** *Weatherwise*, 3(2):30–31, April **1950.** 2 photos. **DWB**—The author is of the opinion that seeding over New York might increase, just as easily as decrease, the rainfall over New England. (*Same item as* 10–45 and 6J–27 *Met. Abs.*) *Subject Headings:* **1. Cloud seeding effects 2. New England.**—*M.R.*

**11M–158** 551.509.617

Contreras Arias, Alfonso, **Resumen de los resultados obtenidos por instituciones oficiales en relación con las experiencias de tratamiento de las nubes por medio del hielo seco y del yoduro de plata.** [Summary of results achieved by official organizations in cloud seeding with dry ice and silver iodide.] *Chapingo*, Mexico City, 4(38):532–545, July **1950.** diagrs., photos, refs. **DA**—Results of experiments made by official institutions in the U. S., Canada, and Hawaii, and opinions of several official authorities concur in pointing out the negative effect of cloud seeding experiments. The author discusses in detail the theoretical and practical factors responsible for this ineffectiveness. However, he recommends further experimentation by competent organizations, in order to obtain a better knowledge of the physical processes involved in precipitation formation. (*Same item as* 6J–30, Oct. 1955, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding.**—*G.T.*

**11M–159** 551.509.617

Dessens, Henri, **Recherches sur la pluie artificielle à l'Observatoire du Puy-de-Dôme.** [Research on artificial rain at the Puy-de-Dome Observatory.] *Annales de Géophysique*, Paris, 6(4):331–344, Oct.–Dec. **1950.** 6 figs., table, 22 refs. French and English summaries p. 331. **DBS**—A report on the results of 33 attempts to produce artificial rain by the use of spray of a saturated sodium chloride solution, carbon dioxide snow and silver iodide. The conditions in the clouds and the properties of the saturated sodium chloride droplets, the weight of which is $10^6$ greater than that of the cloud droplets, leading to successful production of artificial rain, are discussed. Photographs of a cloud seeding experiment with the use of salt solution are given. (*Same item as* 3.1–63, Jan. 1952, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Cloud seeding with salt 3. Puy-de-Dôme, France.**—*I.L.D.*

**11M–160** 551.574.1/2

Dobson, G. M. B., **Centenary symposium on physics of clouds and precipitation. Introductory address.** (In: Royal Meteorological Society, **Centenary Proceedings**, 1950. pub. **1950.** p. 34–36. 5 refs.) **DLC**—Summary of recent work on direct deposition of ice on nuclei in supersaturated air, and chain reaction by splintering of ice. (*Same item as* 2.3–121 and 6F–55, *Met. Abs.*) *Subject Headings:* **1. Condensation nuclei 2. Cloud seeding 3. Cloud physics.**—*C.E.P.B.*

**11M–161** 551.509.617(44)

*Eyraud, R., **La pratique de la pluie artificielle.** [Techniques in artificial production of precipitation.] *France. Météorologie Nationale, Mémorial*, No. 34, **1950.** 44 p. 11 figs., tables, 9 refs. **DWB**—Pt. I of this memoir deals with cloud physics, formation of orographic, frontal and pure convective precipitation, coalescence of drops, and growth by several means, especially in the presence of ice crystals. Pt. II concerns the artificial production of precipitation at temperatures below and above 0°C, both in theory and in practice (with solid $CO_2$ or AgI). The experiments made in France, both in the laboratory and in the field with data on limiting conditions and actual conditions in flight, and success achieved for various types of clouds (40 cases—3 in Morocco, 6 in Tunisia and 31 near Paris) are reviewed. Pt. III comprises a detailed, illustrated account of techniques employed (preparation, equipment, flight plan, etc.). The appendix gives nomograms for calculation of precipitable water from depth of clouds, temperature at base and top, and height of cloud base. (*Same item as* 6J–31, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud physics 2. Cloud seeding techniques 3. France.**—*M.R.*

**11M–162** 551.509.617

Fleming, Roscoe, **Making rain "seeding" clouds can produce extra KWH at low cost.** *Public Power*, Wash., D. C., 8(10):15–17, 30 Oct. **1950.** 3 figs. DA (3358P96)—The successful operations of California Electric Power Co. in the Nevadas, STEWARD CUNDIFF's in 1947 and Krick's are reported. SCHAEFER'S and VONNEGUT'S optimistic forecasts are cited. The operation of ground generators is explained and illustrated, the advantages of scientific seeding are enumerated, and many potentialities, as forest fire and hail control are indicated, quoting LANGMUIR about all the potentialities of nuclear fission without the horrors. *Subject Heading:* **1. Cloud seeding potentialities.**—*O.T.*

**11M–163** 551.509.617

Flohn, Hermann, **Künstliche Erzeugung von Regen?** [Artificial rain making?] *Naturwissenschaftliche Rundschau*, 3(2):78–79, Feb. **1950. DA**—A brief and critical review of various attempts made in the United States, South Africa and Australia to produce artificial precipitation. German work on the formation of ice crystals under experimental conditions, under natural conditions in clouds (H. WEICKMANN) and in supercooled ground fog (E. WALL), and seeding with silver iodide and dry ice in the United States are discussed. The author concludes that artificial rain can be produced only from such clouds which would yield rain naturally. Of significance is the proportion of ice crystals to supercooled water drops in the cloud; the most favorable rates for the production of rain is $1:10^3$. (*Same item as* 2.4–39 and 6J–32, *Met. Abs.*) *Subject Heading:* **1. Artificial precipitation.**—*I.L.D.*

**11M–164** 551.509.617(410)

Frith, Ronald, **Artificial nucleation of clouds.** *Meteorological Magazine*, London, 79:5–9, Jan. **1950.** Also his **Artificial stimulation of rain.** *Ibid.*, 79:9–10, **1950.** 8 photos. **DWB**—Summarizes physics of seeding clouds by dry ice pellets to produce or control rain, prevent hail or thunder, or clear cloud. Results of four trials in England are discussed, also an attempt to end drought in Teesdale. Some slight effects recorded. (*Same item as* C–196, March 1950, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding 2. England.**—*C.E.P.B.*

**11M–165** 551.509.617

Frostenson, P. D., **Kan man göra regn?** [Is it possible to make rain?] *Lantmannen*, Stockholm, 34(51):993–994, Dec. 23, **1950.** refs. **DA** (11L234)—The scientific basis of artificial rainmaking and practical experiments, chiefly in the United States are surveyed. *Subject Heading:* **1. Cloud seeding studies.**—*O.T.*

**11M–166** 551.509.617(931)

Gabites, J. F., **Artificial stimulation of rainfall.** *New Zealand. Meteorological Office, Circular Note*, No. 66, Nov. 13, **1950.** 6 p. 9 refs. **DWB**—Clouds whose tops have temperatures between 0°C and −10°C or −15°C normally contain supercooled liquid water droplets. The introduction of suitable sublimation nuclei such as silver iodide crystals, or the formation of ice crystals following the passage of pellets of solid carbon dioxide, results in a change from a liquid to an ice crystal cloud. In favorable conditions, large snowflakes may form and melt into raindrops, resulting in the dissipation of the cloud as a trial of precipitation, some of which may reach the ground. Nucleation with silver iodide smoke from the ground is cheap but offers little control of the time or place of the cloud seeding. If no favorable opportunities are to be lost, seeding from aircraft becomes necessary. It is estimated that the average rainfall over the Taupo Catchment could be increased by an amount of the order of one tenth of one per cent, with a value in terms of electricity of the order of m2000 per annum. The cost of the operation would probably exceed this figure several fold. (*Same item as* 5.5–75, 6F 57 and 6J–33, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Cloud seeding with silver iodide 3. Taupo Catchment, New Zealand.**—*Author's abstract.*

**11M–167** 551.509.617(747)

Howell, Wallace E., **More rain for New-Yorkers?** *Weatherwise*, 3(2):27–29, April **1950.** 3 photos. **DWB**—Brief description of proposed scheme for filling New York City reservoirs, at that time only 40% full. Pictures of important persons involved in project and of a cumulus cloud at Albuquerque before and after seeding (by Langmuir). (*Same item as* 10–46, Oct. 1950, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Cloud seeding 3. New York.**—*M.R.*

**11M–168** 551.509.617(569.4)

Israel. Rainfall Research Committee, **A preliminary report on experiments for the production of artificial rain in Israel.** Hakirya, **1950.** 3 p. Mimeog. **DWB**—Clouds were seeded with dry ice and with an aqueous suspension of silver iodide. Methods of seeding and verifications are described. Only 7 of 14 clouds seeded were considered suitable for artificial production of rain. In

two cases, showers resulted; in two more, rain was produced but could not be attributed to seeding; in two others, virga followed the seeding. The other 7 clouds were either limited in vertical extent by inversions or their tops had a temperature above −8°C and seeding either lowered their cloud tops or dissipated them. (*Same item as* 2.4–40, April 1951, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Israel 2. Israel.**—*I.L.D.*

**11M–169** 551.509.617

Jurwitz, L. R., **Rainmaking.** *Arizona Cattlelog*, 5(11):38, July **1950. DA** (43.8Ar42)—Artificial rain by cloud seeding, although probable, needs further facts to be ascertained beyond doubt. *Subject Heading:* **1. Cloud seeding.**—*O.T.*

**11M–170** 551.509.617

Kaempffert, Waldemar, **Rain made by cloud-seeding might possibly relieve New York City's water scarcity.** *New York Times*, Sunday, Jan. 29, **1950.** p. E9. **DLC**—Irving Langmuir's report on General Electric's cloud seeding experiments is reviewed. Theories of rain formation are described. Practical application is considered. (*Same item as* C–197, March 1950, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding.**

**11M–171** 551.509.617

Katchalsky, E. and Neumann, Hava, **Preparation of colloidal silver-iodide water-suspensions for nucleation of supercooled clouds.** *Nature*, London, 165(4189):244–245, February 11, **1950.** photo, 5 refs. **DWB**—The method of preparing colloidal silver iodide water suspension is described. The size of the particles is 0.1$\mu$ in diameter and the particles are of the same order of magnitude as those obtained in the generation of smoke by vaporizing silver iodide. The silver iodide produced clouds in a refrigerator and showed no aging when tested after 14 days. (*Same item as* 2.4–41, Feb. 1951, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding with silver iodide.**—*I.L.D.*

**11M–172** 551.509.615

Korczyn, Julius and Clark, D. D., **Dissipation of fog.** *Weather*, London, 5(5):185–186, May **1950. DWB**—Two letters discussing possibility of dissipating fog by release of dry air or silica gel. Clark finds cost prohibitive. (*Same item as* 6–28, June 1950, *Met. Abs.*) *Subject Heading:* **1. Artificial fog dissipation.**

**11M–173** 551.509.617:016

†Kramer, Harris P. and Rigby, Malcolm, **Selective annotated bibliography on cloud physics and "rain making."** *Meteorological Abstracts and Bibliography*, Boston, 1(3):174–205, March **1950.** 204 refs. **DWB**—Items C–101 to C–204 are annotated references to "rainmaking and artificial nucleation of clouds." There are 19 items for the period 1891–1945 (giving the principal points of interest in the history of rainmaking) and 85 for 1946–1950. These references are being repeated in our present bibliography and therefore should be considered as supplementary to it. (*Same item as* 6F–62 and 6J–34, *Met. Abs.*) *Subject Headings:* **1. Weather modification 2. Bibliographies.**—*G.T.*

**11M–174** 551.509.617:546.57:546.15

Krick, Irving P., **Thorough advance research and planning imperative for successful rainmaking.** *New Mexico Stockman*, Santa Fe, 15(7):46, July **1950.** Also his **How a scientist can increase rain through proper use of silver iodide.** *Ibid.*, 15(8):32–33, Aug. 1950. And his **Why rain making in one region doesn't materially decrease moisture in others.** *Ibid.*, 15(9):46, Sept. **1950. DA** (49 N462)—The effects of cloud seeding and the needs of a particular area have to be reconciled by thorough research. The bases of rain increase and overseeding are explained by a description and illustration of silver iodide operations. A properly conducted cloud seeding operation does not affect the precipitation in any other area by more than one hundredth of an inch. *Subject Headings:* **1. Artificial precipitation 2. Cloud seeding with silver iodide.**—*O.T.*

**11M–175** 551.509.617(789)

Langmuir, Irving, **Control of precipitation from cumulus clouds by various seeding techniques.** Based on a paper presented Jan. 25, 1950 before the American Meteorological Society in New York City. Abstract and discussion in *Science*, Wash., D. C., 112(2898):35–41, July 14, **1950.** 3 refs., 4 eqs. **DLC**—This substantial paper contains a lucid description of physical processes leading to precipitation formation from cumulus clouds; effects of dry-ice seeding; factors to be considered in choosing time and place for seeding operations; the author's "cause and effect versus probability" theory; and discussion and evaluation of cloud seeding experiments by means of silver iodide carried out near Albuquerque, N. M., in Oct. 1948 and July 1949. The author claims both immediate and prolonged effects and considers the possibility of a modification of climate on a continental scale. He also believes that hurricanes can probably be modified by seeding large clouds which tend to

grow into incipient hurricanes. (*Same item as* 6J–35, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in New Mexico 2. Hurricane control 3. Albuquerque, N. M.**—*G.T.*

**11M–176** 551.509.617:517.512.2(73)

Langmuir, Irving, **A seven-day periodicity in weather in United States during April, 1950.** *American Meteorological Society, Bulletin*, 31(10):386–387, Dec. **1950.** 2 tables, 2 eqs. **Comment by** William Lewis, *Ibid.*, 32(5):192, May **1951.** table. **DWB**—Langmuir asserts that a seven-day periodicity was introduced into the weather in the United States during April 1950 by silver iodide from a ground-based generator. Temperature data at 850 mb level over Chicago, April 2–29, 1950 are analyzed by the Fisher F-test. The odds against the existing 7-day periodicity being the result of chance are two million to one. At the same time correlation coefficients for temperatures at 850 mb in excess of +0.5 occurred over an area of 1,300,000 sq mi from Oklahoma to Washington, D. C. A specific procedure for evaluating the results of periodic seedings is outlined. In his note, Lewis states that he examined free-air temperature data for March, April and May for the period 1938 through 1942 at Chicago, Joliet and Bismarck according to the procedure suggested by Langmuir. Using the criterion of significance established by Langmuir, seven-day periodicities were found in 2 of the 5 spring seasons examined. (*Same items as* 2.7–52, 3.4–157 and 6J–36, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding evaluation 2. Cloud seeding periodicities 3. Temperature periodicities 4. United States.**—*I.L.D.*

**11M–177** 551.574.2:551.509.617

Lewis, William. **The importance of artificial nucleation for the production of precipitation.** *New York Academy of Sciences, Transactions, 2nd Ser.*, 12(8):264–267, June **1950. DLC**—The author criticizes the theory upon which is based the belief of the importance of artificial nucleation for producing rainfall. On the basis of a study of the formation of "altostratus" and "cumulonimbus" clouds he concludes that the existence of circulation patterns facilitating sufficient lifting for the production of precipitation will bring about a natural formation of ice crystals and the release of available moisture. (*Same item as* 3.3–78 and 6H–184, *Met. Abs.*) *Subject Headings:* **1. Nuclei theories 2. Artificial precipitation.**—*I.L.D.*

**11M–178** 551.509.617:342.5

**New York City rainmaking program upheld.** *American City*, New York, 65(10):165, Oct., **1950. DLC**—The decision of Supreme Court, New York County, May 11, 1950 emanating in the case of a resort hotel in the Catskill watershed area vs. City of New York is presented. The plaintiff's action was directed against a series of experiments during the spring and summer of 1950 by Wallace Howell on account of the water shortage in the city's reservoirs, arguing that it would cause floods harming the resort business. The court decided in favor of the city, holding that plaintiff had no vested rights in the clouds, and no damage would result, at least compared with the benefit to the city. *Subject Headings:* **1. Artificial precipitation 2. Legal aspects of weather control.** —*O.T.*

**11M–179** 551.509.617

**On the results of recent experiments in the artificial production of precipitation.** *American Meteorological Society, Bulletin*, 31(9):346–347, Nov. **1950. DWB**—D. N. Yates, President of the AMS, presents a letter prepared by a committee consisting of B. Haurwitz, G. Emmons, G. Wadsworth and H. C. Willett. The Committee considers two possible approaches to the problem of evaluating cloud seeding experiments (estimate of probable precipitation to be expected from prevailing weather pattern, or estimate of the probability of occurrence by chance alone) and concludes that "the possibility of artificially producing any useful amounts of rain has not been demonstrated so far." A note by Irving Langmuir is added, in which he refers to data showing evidence of a weekly periodicity of rainfall due to silver iodide seeding. *Subject Headings:* **1. Cloud seeding periodicities 2. Cloud seeding evaluation. I. Yates, D. N. II. Haurwitz, B. III. Emmons, G. IV. Wadsworth, G. V. Willett, H. C. VI. Langmuir, Irving.**—*G.T.*

**11M–180** 551.509.615:551.509.616:551.574.1

Pauthenier, M., **Electrical coalescence of fog and clouds.** (In: Royal Meteorological Society, **Centenary Proceedings, 1950.** Pub. **1950.** p. 60 61. 2 refs., eqs.) **DWB**—Summary of papers by Pauthenier on clearing of fogs by seeding with charged droplets. (*Same item as* 2.4–37, April 1951, *Met. Abs.*) *Subject Headings:* **1. Artificial fog dissipation 2. Artificial cloud dispersal 3. Condensation nuclei.**

**11M–181** 551.509.617(94)

Pawsey, J. L., **Australian work on seeding of cumulus clouds with "dry ice."** *International Union of Geodesy and Geophysics. Association of Meteorology, Oslo* 1948, *Transactions*, Vol. 2, pub.

**1950.** p. 50–52. Mimeographed. **DWB**—An experiment on the production of artificial rain from cumulus clouds seeded with dry ice is described. Seeding was followed by the development of cumulonimbus clouds and by considerable rainfall. Approximately simultaneously rainfall was recorded only from cumulus clouds associated with a front 180 miles distant. (*Same item as* 3.1–65, Jan. 1952, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with dry ice 2. Australia.**—*I.L.D.*

**11M–182** 551.574.1:551.576

†Perrie, D. W., **Cloud physics.** New York, John Wiley and Sons, **1950.** 119 p. 7 figs., 30 plates, append. with 3 tables, glossary, bibliog. p. 109–114. **DWB**—An excellently illustrated and readable book on many aspects of cloud forms, cloud formation and cloud physics. Chapters on condensation and sublimation nuclei, natural and artificial precipitation, cloud observation and forecasting, effects of clouds on aviation, optical and electrical phenomena associated with clouds, and clouds in the stratosphere (noctilucent and nacreous clouds) are none too technical for the ordinary layman to understand. There is a good guide to cloud identification and an unannotated bibliography of over 100 references. (*Same item as* 2.5–125, May 1951, *Met. Abs.*) *Subject Headings:* **1. Cloud formation 2. Cloud classification 3. Cloud physics.**—*M.R.*

**11M–183** 551.509.617

Perron, Marc A., **La pluie artificielle.** [Artificial rain.] *Foyer Rural*, Montreal, 9(10):6, July **1950. DA** (7F83)—Explains the conditions favorable for artificial precipitation. Successful operations in Canada, the United States and France are surveyed. *Subject Heading:* **1. Artificial precipitation.**—*O.T.*

**11M–184** 551.509.617(747)

Pierson, Willard J., Jr., **Large scale control of weather by introduction of sublimation nuclei into the atmosphere.** *New York Academy of Sciences, Transactions*, Ser. 2, 12(8):268–270, June **1950. DLC**—A critical discussion of several instances in which rainfall was produced presumably by seeding of clouds with AgI. Of a case (*Life*, Feb. 20, 1950) in which a cloud 25 mi away from the AgI generator gave rise to a full scale thunderstorm, it is shown that surface and vertical wind velocity are such as to have prevented the AgI from reaching atmospheric levels where it could become effective. In the other instance which involved rainmaking over New York State (April 25, 26, 1950), the air into which AgI was released was capped by an inversion and the prevailing lapse rates would have prevented the AgI from reaching the freezing level where it becomes effective. (*Same item as* 3.3–80 and 6J–37, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Cloud seeding with silver iodide 3. New York.**—*I.L.D.*

**11M–185** 551.509.6

Reichelderfer, F. W., **Can we change the weather?** *U. S. News and World Report*, March 3, **1950.** p. 19–20. 3 figs. **DWB**—A series of questions about rain making, cloud seeding, storm control and climatic changes are answered by Dr. Reichelderfer, the Chief of the U. S. Weather Bureau. The conclusion is that experiments in cloud seeding, while at present not conclusive, may lead to results in prevention of thunderstorms or other incidental benefits, even though not resulting in economically important increase in rainfall. We do not know enough about climatic cycles and changes to predict more than a month ahead with any skill. The work of the Weather Bureau in cloud physics experiments and forecasting is outlined. (*Same item as* 3.1–66, and 6J–38, *Met. Abs.*) *Subject Headings:* **1. Weather control 2. Cloud seeding effects 3. Climatic changes 4. U. S. Weather Bureau.**—*M.R.*

**11M–186** 551.509.617:551.578.7(795)

Richards, Leverett G., **Cloud cowboys,** *Pacific Grange Farmer*, Oct. **1950.** p. 3–5. 5 figs. **DA** (GP115)—The effective hail-control flights of Harvey Brandau and Eugene Kooser over Rogue River Valley in southern Oregon in 1950 are reported. Their secret liquid, contrary to Vincent J. Schafer's silver iodide, will work on any water cloud, hot or cold, anywhere, any time. Fog was cleared out by them over the Toketee falls in the spring of 1950. The activities of Krick's Water Resources Development Corporation are reported. Pictures illustrate various cloud formations under operation, and the chart room of Water Resources Development Corporation. *Subject Headings:* **1. Cloud seeding effectiveness 2. Hail prevention in Oregon 3. Rogue River Valley, Oregon.**—*O.T.*

**11M–187** 551.509.617

Richards, Leverett G., **They really make it rain.** *Country Gentleman*, Philadelphia, 120(7):19, 60–61, July **1950.** photo. Condensed in *Reader's Digest*, 57(339):63–67, July **1950. DLC**—Spectacular results of scientific and commercial weather modification and hail control, obtained by means of dry-ice and silver-iodide seeding, are referred to with hopeful enthusiasm (experiments in

tropical regions, results of Project Cirrus, KRICK'S successful operations, etc.). Against the background of brilliant rainmaking achievement Weather Bureau pessimism is made to appear as unduly conservative. (*Same item as* 6J–39, Oct. 1955, *Met. Abs.*) *Subject Heading:* **1. Weather control.** —*G.T.*

**11M–188** 551.509.617

Schaefer, Vincent J., **Economic aspects of experimental meteorology.** (In: United Nations Scientific Conference on the Conservation and Utilization of Resources, Lake Success, N. Y. 1949, **Proceedings, v. 4, Water resources,** p. 2–27, **1951.** 23 figs., 29 refs.) **DWB**—Also issued under title: **Experimental meteorology.** *Zeitschrift fur angewandte Mathematik und Physik*, 1(3,4):153–184, 217–236, May 15, July 15, **1950.** 38 figs., 2 tables, 28 refs. **DLC**—A carefully prepared report with numerous photographs showing some effects of cloud seeding (dissipation or precipitation artificially induced), mostly with dry ice. A general review is given of nuclei in the atmosphere, causes of natural precipitation fundamental experiments in cloud physics and requirements for cloud seeding. A diagram shows the temperature dependence for ice nuclei of different natural substances which may occur as aerosols in the atmosphere. The greatest activity occurs with solid $CO_2$ at 0°C or lower and, to a lesser degree, AgI which becomes fully active at −10°C. (*Same item as* 6J–40, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding effects 2. Cloud physics 3. Condensation nuclei.**—*A.A.*

**11M–189** 551.509.616/7:551.574.11

Schaefer, Vincent J., **The effects produced by seeding supercooled clouds with dry ice and silver iodide.** (In: Royal Meteorological Society, **Centenary Proceedings, 1950,** pub. **1950.** p. 42–50. 6 figs., 15 refs.) **DWB**—After a historical introduction, the present field and laboratory studies by Project Cirrus are listed. Concentration of ice particles varies from less than 10 to more than $10^7/m^3$; at least $10^4$ is required for cloud transformations to occur and persist. Results of seeding are described and illustrated by photos. The discussion, p. 63–65, is mainly on this paper. (*Same item as* 2.4–38 and 6J–41, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding effects 2. Project Cirrus 3. Condensation nuclei.**

**11M–190** 551.574.1:551.509.617

Schaefer, Vincent J., **Induced precipitation and experimental meteorology.** *New York Academy of Science, Transactions*, Ser. 2, 12(8):260–264, June **1950.** 12 refs. **DLC**—The physical properties of the atmosphere important in the formation of artificial rain, namely: supercooled clouds, ice nuclei and synoptic conditions are discussed. (*Same item as* 3.5–101, May 1952, *Met. Abs.*) *Subject Headings:* **1. Cloud physics 2. Experimental meteorology.**

**11M–191** 551.509.617

Schaefer, Vincent J. and Vonnegut, Bernard (*Assignors to General Electric Co., New York*), **Method of crystal formation and precipitation.** *U. S. Patent Office, Patent* No. 2,527,230, Oct. 24, **1950.** [2 p.] refs. Also: Vonnegut, Bernard, **Method of generating silver iodide smoke.** *Ibid.*, No. 2,527,231, Oct. 24, **1950.** [2 p.+plate] diagr., refs. **DP**—The first patent is based on an application of Jan. 21, 1948. It relates to a method for causing crystallization in supersaturated vapor containing gases, or in supercooled liquids, by the introduction of foreign nuclei of a designated crystalline structure. The second patent indicates a method for obtaining a large number of AgI particles by spraying a solution of AgI into a flame. The apparatus is shown in a diagram and the technique described in detail. (*Same item as* 6J–42, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding patents 2. Silver iodide generator patents 3. Patents.**—*G.T.*

**11M–192** 551.578.7:551.509.617

Schweizerische Vereinigung für Hagelbekämpfung, **Von Gewittern, dem Hagel und der Hagelabwehr.** [Thunderstorms, hail and hail control.] *Die Grüne*, Zurich, 78(31):849–852, Aug. 4, **1950. DA** (17Sch9)—The high forest is considered as a hail barrier. Weather conditions are explained as a consequence of temperature differences in the atmosphere, and the development of thunderstorms as a result of whirlwind activity. The effect of hail rockets in 1950 against hail development is demonstrated. Their effectiveness depends on reaching the clouds directly at the height of 1500 m. Hail damage control should be accompanied by insurance against hail damage. *Subject Heading:* **1. Hail prevention.**—*O.T.*

**11M–193** 551.509.617(09)

Sidgwick, J. B., **Man makes rain.** *Countryman*, Burford, 42(1):56–60, Autumn **1950. DA** (281.28C832)—A survey of the development of cloud physics and artificial rain production. AITKEN'S theory on condensation nuclei (1880) and THOR BERGERON'S discovery of ice crystals are explained. Successful experiments with dry ice in a deep freezer, as witnessed by the author in the

United States, SCHAEFER'S successful attempts with dry ice, the experiment at Albuquerque, New Mexico based on VONNEGUT'S suggestion on silver iodide, LANGMUIR'S experiments in 1946 and 1947, and those of the South African Council for Scientific and Industrial Research in 1947–48, the trials of KRAUS and SQUIRES in Australia in 1947, and those of the U. S. Weather Bureau in Ohio and Alabama in 1948 and 1949, the attempts in the Teesdale Catchment area in 1949, finally WALLACE'S large-scale operation in New York State are described and evaluated. *Subject Headings:* **1. Progress in cloud seeding 2. History of cloud seeding.**—*O.T.*

**11M–194** 551.509.617:551.508.85

Smith, E. J., **Observation of precipitation with an airborne radar.** *Australian Journal of Scientific Research, Ser. A, Physical Sciences*, 3(2):214–223, June **1950.** 14 figs., plate, 2 tables, 6 refs. **DLC**—Precipitation was induced artificially by seeding a cloud with dry ice. The precipitation was studied by means of a radar set mounted in an aircraft, with beam directed downward. The equipment and its installation are described and illustrated with photographs. The observed visual effects after seeding are given and the radar echoes are interpreted. Evidence is presented that the rain was formed from ice crystals produced by the seeding. (*Same item as* 2.8–43 and 6J–43, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with dry ice 2. Radar analysis of rain.**—*I.L.D.*

**11M–195** 551.509.617:551.578.7(494.5)

Thams, J. C., **Gli esperimenti swizzeri per combattere la grandine.** [Swiss experiments in hail control.] *Humus*, Milan, 6(4):23–25, April **1950.** figs. **DA**—Describes the hail control network set up as a 5-year experimental project in the Magadino Plain. Operations comprise the following phases: 1) warning service, 2) protection service (by means of explosive rockets) and 3) reporting service. The network of the 50 launching sites is shown on maps. Results not yet available. (*Same item as* 6J–44, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Hail prevention in Switzerland 2. Magadino Plain, Switzerland.**—*G.T.*

**11M–196** 551.509.617(09)(73)

Thomas, Norman F., **Rain making 60 years ago.** *Dakota Farmer*, Aberdeen, 70(19):14–15, Oct. 7, **1950. DA** (6D14)—Rain making experiments since 1890 are surveyed. The drought period of 1890–1895 caused only disappointment to rainmakers. In the 1890's the first experiments of GENERAL RUGGLES and MAJOR DRYENFORTH, in Texas were based on effects of explosion and the first "Rain Company" was organized in Goodland, Kan. A. B. MONTGOMERY reached some success by his experiments in Doland, S. D. and at Aberdeen in June 1891. The experiments of PROF. JOHN ELLIS and COLONEL JOHN H. KING were unsuccessful from August 26 to September 16 because of too much natural rain, but the Goodland Company gathered at least clouds on its first test at Hermosa. A man called JEWELL experimented in 1894 around Sioux Falls with chemicals and gases; his apparatus with pipes mounted on a boxcar produced no rain at that time but one inch later in Brown County. In 1933 A. W. HALLER operated in the Black Hills when a real "soaker" fell for the Harding County people. *Subject Headings:* **1. History of weather control 2. Cloud seeding case histories 3. U. S. A.**—*O.T.*

**11M–197** 551.509.34:551.577.51(929)

U. S. Weather Bureau, **Physical basis for production of rain in Hawaii.** Wash., D. C., U. S. Weather Bureau, Aug. **1950.** 13 p. 7 figs., 11 refs. **DWB**—Based on experience of Weather Bureau forecasters in Hawaii, several conclusions are drawn as to the factors which are necessary for rainfall in that area. First, it is stated that ice crystals nuclei are not necessary, but that thickness of the cloud is the most important factor in determining rate of rainfall. However, the heaviest rainfall occurs from clouds whose tops are above the 0° isotherm. Heaviest rains occur with occluded cyclones or cold lows. These rains account for half the total rainfall but only a small percentage of the occurrences. Most of them are accounted for by horizontal convergence in the surface layer of easterlies as evidenced by troughs in the upper troposphere, or by eastward movement of surface highs north of Hawaii. Orographic effects are important in combination with other factors. (*Same item as* 3.1–61, Jan. 1952, *Met. Abs.*) *Subject Headings:* **1. Hawaiian Islands 2. Orographic rainfall 3. Warm clouds 4. Cloud physics.**—*M.R.*

**11M–198** 551.577.11:551.576:551.509.617(969)

Vierhout, R. R., **On the formation of rain in clouds not reaching up to the freezing level.** *Journal of Meteorology*, Boston, 7(3):223–226, June 1950. 3 refs., 8 eqs. **DWB**—Computations made by the author indicate that Langmuir's chain reaction theory for precipitation formation in clouds seeded over Hawaii is not sufficient. An alternate explanation that falling dry ice pellets produce evaporation and resulting disturbances leading to coalescence is presented and suggested as mechanism whereby rain forms in the subtropics at levels below the zero isotherm. (*Same item as* 8-94

and 6J 45, *Met. Abs.*) *Subject Headings:* **1. Cloud physics 2. Cloud seeding in Hawaii 3. Langmuir's theory 4. Rain from nonfreezing clouds 5. Hawaii.**

**11M–199** 551.509.617

Vonnegut, Bernard, **Experiments with silver iodide smokes in the natural atmosphere.** *American Meteorological Society, Bulletin*, 31(5):151–157, May **1950.** 10 figs., 9 refs. **DWB**—Description of seeding experiments carried out from an airplane on Dec. 21, 1948, using AgI and dry ice alternately. Photographs of top of stratus deck after seeding show results. Preliminary experiments at tracing silver iodide smokes and ground released smokes, and apparatus used in dispensing chemicals for seeding purposes are also described. (*Same item as* 7 28 and 6J–46, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding with silver iodide.**—*M.R.*

**11M–200** 551.574.2:551.509.617

Vonnegut, Bernard, **Techniques for generating silver iodide smoke.** *Journal of Colloid Science*, 5(1):37–48, Feb. **1950.** 6 figs., 7 refs. **DLC**—Silver iodide smoke for seeding supercooled clouds may be generated by either a charcoal burning device (wherein the charcoal is impregnated with silver iodide) or a spray nozzle type smoke generator. Charcoal burners for ground or airplane use and a new turbo-jet burner for producing large numbers of particles are described. Methods of preparing solutions of AgI, numbers of nuclei produced per second, etc., are discussed. (*Same item as* 2.4 44 and 6J–47, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with silver iodide 2. Silver iodide smoke generators.**—*M.R.*

**11M–201** 551.509.617(09)

Walker, C. Lester, **The man who makes weather.** *Harper's Magazine*, 200(1196):63–70, Jan. **1950. DLC**—Popular article about VINCENT SCHAEFER'S life and work with General Electric, especially his snowflake replicas and cloud seeding experiments. Seeding with dry ice, water, and silver iodide discussed. (*Same item as* C-203, March 1950, *Met. Abs.*) *Subject Headings:* **1. History of cloud seeding. I. Schaefer, Vincent S.**

**11M–202** 551.509.617:551.578.7

Walmsley, L. G., **A general beats the hail.** *Farmer and Stock-Breeder*, London, 64:2108, July 18, **1950. DA** (10F228)—Explains hail formation in cyrrus, nimbus and cumulo-nimbus clouds. FRANÇOIS RUBY'S successful experiments with batteries of rockets, started in 1936, and successively extended to twenty-eight French departments, Algeria, Morocco and Spain are described. The studies in Switzerland and Italy are discussed. *Subject Headings:* **1. Hail formation 2. Hail shooting.**—*O.T.*

**11M–203** 551.509.617:551.579(794)

**Cloud-seeding pays off out West.** *Aviation Week*, N. Y., 52(16):39, April 17, **1950. DLC**—Cloud seeding flights over the Sierras in California are claimed to have produced enough snow to add 2 billion gallons of water to reservoirs of the California Electric Power Co. Dry ice was used because the low flying required for silver iodide seeding is dangerous in the Bishop Valley area. Cost was about $200 per hour of flight. (*Same item as* 2.9–49 and 6J–28 *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in California 2. Water supply 3. California.**—*M.R.*

**11M–204** 551.509.617:551.579(794)

**Cloud seeding works in California.** *Electrical World*, 133(11):70–72, March 13, **1950.** 5 photos. **DLC**—California Electric Power Co. has conducted experiments for two years in the Bishop Basin (High Sierras), using dry ice to seed cumulus clouds 21 times, 14% in 1948 and 12% in 1949. Series of cloud photographs show rapid results obtained from one seeding operation. Chart shows relief of valley. (*Same item as* 8–29 and 6J–29, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with dry ice 2. Water supply 3. Cloud seeding in California 4. California.**—*M.R.*

**11M–205** 551.509.617(437)

**Poznámka k problému umělého deště.** [Note on the problem of artificial rain.] *Meteorologické Zprávy*, Prague, 4(1/2):53–54, **1950. DLC**—In the weekly, *Svět Práce*, No. 12, March 23, **1950,** JAN DUBSKÝ published an article under the title **Útok proti obloze** [Attack on the sky], in which he included an enthusiastic report on a cloud seeding generator developed by the Czechoslovak Meteorological Institute, which would soon produce desired amounts of rain. The present note corrects the above statement to the effect that the instrument has not yet been completed, it will take some time to produce it, and results which can be achieved with it are unknown. (*Same item as* 6J–350, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Silver iodide smoke generators 2. Cloud seeding in Czechoslovakia 3. Czechoslovakia. I. Dubský, Jan.**—*G.T.*

**11M–206** 551.576.1

**Project Cirrus.** *American Meteorological Society, Bulletin*, 31(8):286–287, Oct. **1950. DWB**—The activities and results accomplished by General Electric in its cloud physics research project since 1947 are outlined. (*Same item as* 2.4–126, April 1951, *Met. Abs.*) *Subject Heading:* **1. Cloud physics research.**

**11M–207** 551.509.617(747)

**Rainmakers need a better yardstick.** *Engineering News-Record*, 145(13):34–35, Sept. 28, **1950. DLC**—An interview with Dr. W. E. HOWELL regarding the results of attempts to increase the New York water supply by artificial seeding of clouds. No certainty exists as to the success of artificial inducement experiments, but statistical tests are being conducted which will show eventually the significance of any increase in rainfall over chance. (*Same item as* 2.4–42, April 1951, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding in New York.**—*M.R.*

**11M–208** 551.509.617

**Rain making debated.** *Science News Letter*, 57(4):61, Jan. 28, **1950. DLC**—The practicality of rainmaking is reviewed with respect to the proposed $50,000,000 appropriation that Congress is considering for research on rainmaking. Schaefer's and Wexler's opinions are expressed. (*Same item as* C–199, March 1950, *Met. Abs.*) *Subject Heading:* **1. Artificial precipitation.**

**11M–209** 551.509.617

**Rainmaking—past and present.** *Weatherwise*, 3(2):26, 46, April **1950. DWB**—Note on history, present status and future of this controversial field of applied meteorology. (*Same item as* 11–39, Nov. 1950, *Met Abs.*) *Subject Headings:* **1. Artificial precipitation 2. History of weather control.** —*M.R.*

**11M–210** 551.509.617(789)

**Solution to water shortage: rain makers' success shows how New York could fill its reservoirs.** *Life*, 28(8):113–116, 119, Feb. 20, **1950.** Photos. **DLC**—Popular account of silver iodide seeding tests in New Mexico, summer of 1949. Silver iodide released from ground caused a small cloud which had given no radar echo of rain to grow into "heaviest man-made rainstorm." (*Same item as* C–201, March 1950, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding 2. New Mexico.**

**11M–211** 551.509.6

**Weather control, governmental function?** *American City*, New York, 65(12):115, Dec., **1950. DLC**—Rainmaking is foreseen as a political issue and a possible international dispute because seeding operations can result in nation-wide weather effects. *Subject Heading:* **1. Legal aspects of weather control.**—*O.T.*

**11M–212** 551.509.617(09)

**Weather or not.** *Time*, 56(9):52–56, Aug. 28, **1950.** 6 photos, picture of Dr. Langmuir on cover. **DLC**—A semi-popular account of the history of cloud seeding techniques worked out by LANGMUIR and SCHAEFER, and applied by them to show the possibility of weather control—especially the relief of drought by cloud seeding. Applications in New York by HOWELL and in the Far West by IRVING KRICK are also discussed. Mention is made of the experiments by DR. WORKMAN at the New Mexico School of Mines Laboratory. Photographs of all of the above named investigators are included. (*Same item as* 2.4–45, April 1951, *Met. Abs.*) *Subject Headings:* **History of cloud seeding. I. Langmuir, Irving.**—*M.R.*

## 1951

**11M–213** 551.509.617

Alter, J. Cecil, **Whose rain?** *Idaho Farmer*, Boise, 69:580, 588, Aug. 2, **1951. DA** (6G282)—It is demonstrated that cloud seeding is most effective in as much as it may develop or expand incipient rainstorms into beneficial rains. July, never without rain in the Salt Lake valley, offers ample opportunity for most favorable results. *Subject Heading:* **1. Artificial precipitation.**—*O.T.*

**11M–214** 551.509.617:551.574.11:06

American Geophysical Union. Committee on Cloud Physics, **Report, for 1951.** *American Geophysical Union, Transactions*, 32(5):760–764, Oct. **1951.** refs. **DWB**—Recent publications on cloud physics and artificial precipitation are reviewed. The section on artificial nucleation includes seven papers by authors such as ANDERSON, VONNEGUT, LANGMUIR, SCHAEFER, HOUGHTON and others. Section on research concerned with Bergeron-Findeisen ice particle theory and source of ice particles in supercooled clouds includes works by Bowen, Houghton, Ludlam, Levine, Workman, Reiss,

Woodcock, Köhler, and others. (*Same item as* 3.9-182 and 6F–83, *Met. Abs.*) *Subject Headings:* **1. Cloud physics research 2. Artificial precipitation 3. Committee on Cloud Physics.**—*G.T.*

**11M–215** 551.509.617

*American Institute of Aerological Research, Denver, **Analysis of cloud seeding potentialities in the Colorado River Basin of Texas.** Its *Report*, No. 89, Jan. 31, **1951.** 37 p. 24 figs., 6 tables. **DLC** (QC852.A474)—Precipitation data for a score of stations in the Colorado River Basin above Austin, Tex., are analyzed for the period 1935–50 to show possible amount (30%) of increase in stream flow, which would result from an estimated 10% increase in precip. during the warm season if seeding were properly carried out, and to give a basis for evaluation of seeding if and when it is carried out in that area. The basic principles of cloud physics, seeding, weather patterns, generator requirements and methods of evaluation are outlined, and effects of seeding on the economy of the Basin set forth. (*Same item as* 9.9–141, Sept. 1958, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding potentialities 2. Precipitation-runoff relationships 3. Colorado River Basin, Texas.**—*M.R.*

**11M–216** 551.509.617:34

Anderson, Clinton P., **The weather control bill.** *Weatherwise*, Boston 4(1):17–19, Feb. **1951.** photo. **DWB**—The constitutional basis of the bill, the purpose and provisions and a section by section analysis of the bill are presented. (*Same item as* 3.1–62, Jan. 1952, *Met. Abs.*) *Subject Heading:* **1. Weather control legislation.**—*I.L.D.*

**11M–217** 551.509.617:34

Angell, George N., **What's new in rain-making?** *Utah Farmer*, Lehi, 71:188–189, March 1, **1951. DA** (6D45). Also in: *Oregon Farmer*, Portland, 74:171–172, March 1, **1951. DA** (6Or32)—"On the organization side, plenty. Local groups interested in weather improvement have organized to protect themselves from any legal difficulties." DR. KRICK with whom most of the member associations have contracts, claims that properly conducted cloud-seeding will not change the climate. *Subject Headings:* **1. Weather control legislation 2. Cloud seeding effects.**—*O.T.*

**11M–218** 551.509.617

aufm Kampe, Hans J. and Weickmann, Helmut K., **The effectiveness of natural and artificial aerosols as freezing nuclei.** *Journal of Meteorology*, 8(5):283–288, Oct. **1951.** 3 figs., 22 refs. **DWB.** Review in: *Science News Letter*, 60(21):333, Nov. 24, **1951. DLC**—Measurements of the effectiveness of natural and artificial freezing-nuclei were carried out in a room-size cold chamber. The concentration of natural nuclei varied from approximately one per liter at about −13°C to 1000 per liter at −25°C. Since a concentration of 1 to 10 ice crystals per liter is sufficient to produce continuous precipitation, clouds which reach the temperature level of about −15°C should precipitate. In general, this is verified by the observations of several investigators. Investigations of the effectiveness of silver iodide and cobalt iodide indicate that cobalt iodide is almost as effective a freezing nucleus as is silver iodide. However, due to its high hygroscopicity, cobalt iodide probably cannot be used to seed clouds from the ground. The threshold temperature at which silver iodide and cobalt iodide are effective is approximately 10°C higher than that at which natural aerosols of well industrialized and populated regions are effective. Consequently, whenever synoptic situations for appreciable rain exist, it will probably rain without seeding. For special cases, however, seeding may produce noteworthy amounts of rain; but this rain is local and of short duration. (*Same item as* 3.4–183 and 6J–48, *Met. Abs.*) *Subject Headings:* **1. Freezing nuclei 2. Cloud seeding.**—*Author's abstract.*

**11M–219** 551.574.1 551.5(02)

aufm Kampe, Hans J., **Das Wetter und seine Ursachen: neuere Erkenntnisse vom Wettergeschehen.** [Weather and its causes: recent knowledge on weather processes.] Darmstadt, Dietrich Steinkopff, **1951.** 164 p. photos., graphs, charts, 82 refs.—Chs. 9 and 10 (p. 137–153) contain a brief summary of knowledge on condensation, sublimation and freezing nuclei, kinetics of phase transition in water, the effect of vertical velocities on ice cloud formation, ice cloud particles, and artificial cloud modification. Microphotographs of ice crystals from various types of clouds are included. (*Same item as* 6F–85, June, 1955, *Met. Abs.*) (For fuller abstract *see item* 3.5–1, May 1952, *Met. Abs.*) *Subject Headings:* **1. Cloud physics 2. Cloud seeding 3. Textbooks.**—*G.T.*

**11M–220** 551.509.61

Aujeszky, László, **Az időjárás mesterséges befolyásolásának új lehetőségei.** [New possibilities of artificial weather modification.] *Időjárás*, Budapest, 55(5/6):125–130, May/June **1951. DLC**—Among the new techniques of weather modification, the author discusses artificial stimulation of rainfall by cloud seeding, lightning prevention by seeding thunderclouds with ammonia or nucleating agents, hail prevention and fog dissipation by overseeding, and, finally, the Davidov project involving

diversion of the Ob and Yenisei Rivers. (*Same item as* 10.4–141, April 1959, *Met. Abs.*) *Subject Heading:* **1. Weather control.**—*G.T.*

**11M–221** 551.509.617

Aujeszky, László, **A mesterséges esökeltés kérdése.** [The problem of artificial precipitation.] (In: Aujeszky, L. et al., **Mezögazdasági meteorológia.** [Agricultural meteorology.] Budapest, **1951.** p. 159–164. figs.) **DLC**—Atomic fission would be the only adequate source of energy for modifying dynamic processes in the atmosphere (as suggested by the author as early as 1930) but progress in the atomic field is not advanced enough for use in weather modification; moreover such use would probably be uneconomical. Cloud seeding with dry ice is an available technique of cloud modification (artificial precipitation, cloud and fog dispersal). The author reviews the theory of dry-ice seeding and results achieved (Project Cirrus, Australian experiments). Lightning prevention by seeding with ammonia is mentioned. Cloud seeding experiments are planned by the Hungarian Meteorological Institute. (*Same item as* 6J–49, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Cloud seeding with dry ice 3. Lightning prevention.**—*G.T.*

**11M–222** 551.509.617(795)

Beaumont, R. T., **An analysis of cloud seeding operations in North Central Oregon.** *Oregon. Agricultural Experiment Station, Corvallis, Circular of Information,* No. 503, Oct. **1951.** 5 p. 2 figs. **DWB.** Also his: **Report of the first year's analysis of cloud seeding in North Central Oregon.** *Oregon Wheat Growers League, 24th Annual Meeting, 1951, Proceedings.* p. 133–149. **DA**—Cloud seeding by a silver iodide ground generator operated from Sept. 1950 to June 1951 during actual or probable storm conditions. Although 8 out of 10 months showed positive departures from precipitation amounts estimated statistically by means of control area, there was no definite evidence of a positive effect of the seeding operations. (*Same item as* 6J–50, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Oregon 2. Oregon.**—*A.A.*

**11M–223** 551.509.617

Beaumont, R. T., **Cloud milking still uncertain business** (Condensed by George N. Angell). *Washington Farmer,* 86:5, 7, Jan. 4, **1951. DA** (6R151). Also in: *Idaho Farmer,* Boise, 69:5, 17, Jan. 4, **1951. DA** (6G282)—The possibility of cloud modification in some cases is definitely ascertained. The need of a better understanding of the processes associated with rain and of an analysis of all cloud seeding projects by some impartial research agency is emphasized. It seems too early to predict the economic feasibility of induced precipitation. *Subject Headings:* **1. Cloud seeding effectiveness I. Angell, George N.**—*O.T.*

**11M–224** 551.509.617(45)

Bernacca, E., **I primi esperimenti italiani di pioggia artificiale sono stati eseguiti in Sardegna.** [The first Italian artificial precipitation experiments have been carried out in Sardinia.] *Terra e Sole,* Rome, No. 108:303–305, Aug. **1951.** diagrs. **DA**—Near some water reservoirs in Cagliari province cloud seeding operations were undertaken by means of balloon-borne dry ice and ground-based and balloon-borne silver iodide (equipment described and illustrated). From Feb. 17 to March 9, 1951 the height of water in one of the reservoirs was raised from 17 to 28 m. The rainfall obtained is attributed to the seeding operations, as nuclei counts were found too low for natural rain formation. (*Same item as* 6J–51, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Sardinia 2. Cagliari Province, Italy.**—*G.T.*

**11M–225** 551.509.617

Best, A. C., **The artificial production of rain.** London, Meteorological Office, **1951.** 4 p. Mimeographed.—Clear, nontechnical account of present position of seeding by dry ice or AgI. (*Same item as* 3.5–95, May 1952, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with silver iodide 2. Cloud seeding with dry ice.**—*C.E.P.B.*

**11M–226** 551.509.617:34

Binzak, Paul; Buellesbach, Richard P. and Zirbel, Irving, **Rights of private land owners as against artificial rain makers.** *Marquette Law Review,* 34(4):262–275, Spring **1951.** refs. **DLC**—"If the owner of Blackacre, by seeding the clouds passing over his land, reduces the amount of rain which would normally fall on Whiteacre, what right in the owner of Whiteacre, if any, has been violated by such activity?" Seeking an answer the authors try to determine "whether or not a landowner has any rights in the clouds passing over his land and the resulting natural rainfall." By various analogies (illustrated with court decision is reached that the rule of "reasonable user" should be applied. Thus the courts might be justified in ruling that any interference by private individuals with the development of rainfall is illegal. In view of possible significant economic benefits of weather modification activities, the authors believe that "it may be necessary to tolerate

such activities, but only under some type of government supervision." (*Same item as* 6J–52, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Weather control legislation 2. Legal aspects of weather control.**—*G.T.*

**11M–227** 551.509.617

Boice, Henry G., **Contracting for rain.** *Arizona Cattlelog*, 6(9):14–16, May **1951. DA** (43.8Ar42)—The fear that artificial precipitation might cause moisture at the expense of other areas is dismissed as baseless, because only 1% of the moisture in the air will precipitate during a natural rainstorm and not more than 2% would be drained under perfect artificial nucleation. *Subject Heading:* **1. Cloud seeding effects.**—*O.T.*

**11M–228** 551.574.1:551.508.91

Boston University. Dept. of Chemistry, **Physical chemical factors involved in atmospheric phase transitions.** Contract AF 19(122)-168, Reports Nos. 1–5, March 15, **1950**–March 15, **1951.** 5 pieces. tables, refs., eqs. **DWB**—During the project's initial phase covered by these first five reports, laboratory equipment was installed and improved and some theoretical studies completed. The theoretical papers "Time lag in the nucleation of supercooled water clouds by silver iodide smokes," "The kinetics of phase transitions in binary systems," and "The growth of uniform colloidal dispersions" are contained in Reports 1 and 4. An investigation of AgI particles as condensation nuclei, made with the use of a condenser, is described in Report 2. Reports 3 and 5 give detailed descriptions and illustrations of the cloud chamber and attached equipment installed in the project laboratory. Howard Reiss is in charge of both theoretical and experimental work. (*Same item as* 6F–92, June 1955, *Met. Abs.*) *Subject Headings:* **1. Nucleation 2. Cloud physics research 3. Artificial precipitation 4. Cloud chambers. I. Reiss, Howard II. Saltsburg, Howard.**—*G.T.*

**11M–229** 551.501.8:06

Bowen, E. G., **Recent work of the Radiophysics Division, C.S.I.R.O.** *Institution of Radio Engineers, Sydney, Australia, Proceedings*, 12:99–108, **1951.** 18 figs. **DLC**—Includes an account of structure of "freezing" and nonfreezing rain as shown by radar from the air and ground, with photos; measurement of raindrop sizes and water content in the air by a transmitter carried by balloon; and experiments in rain making by dry ice. Vertical air velocity in a cloud was measured by air-borne radar and cloud samples were taken. Wind finding by radar using balloons coated with a silver film gave profiles up to 100,000 ft. A glider carrying meteorological instruments and homing on a radio beam is being developed. Sec. 3 deals with radio astronomy. (*Same item as* 3.10–2 and 6G–37, *Met. Abs.*) *Subject Headings:* **1. Radar analysis of rain 2. Cloud physics 3. Artificial precipitation 4. Radarsondes.**—*C.E.P.B.*

**11M–230** 551.509.617 551.574.1

Braham, R. R.; Reynolds, S. E. and Harrell, J. H., Jr., **Possibilities for cloud seeding as determined by a study of cloud height versus precipitation.** *Journal of Meteorology*, 8(6):416–418, Dec. **1951.** fig., 2 tables, 4 refs. **DWB**—In New Mexico, with cloud-top temperature above −12°C no radar echoes were found, from −12°C to −24°C only one-fifth of the clouds gave echoes. Below −24°C presence of CuNb increased frequency of echoes. Seeding from ground by AgI had no effect. For summer seeding to be effective, cloud must extend from below 14,000 ft to at least 22,000 ft. (*Same item as* 3.5–96 and 6J–53, *Met. Abs.*) *Subject Headings:* **1. Radar echoes from clouds 2. Cloud physics 3. Cloud seeding potentialities 4. Cloud height.**—*C.E.P.B.*

**11M–231** 551.509.617(794)

California. Legislature. Senate, **Senate bill No. 617, An act to provide for the regulation and licensing of interference or attempt to interfere by artificial means with natural condensation and precipitation of rain, snow, moisture of water in any form contained in the atmosphere . . . 1951. DWB**—Any activity aimed at artificial stimulation or prevention of precipitation without a license issued by the Department of Public Works acting through the State Engineer is prohibited through this act. Instructions are given regarding application for such license and notice of intended operations. Provisions are made for emergency nucleation projects. (*Same item as* 3.11–87, Nov. 1952, *Met. Abs.*) *Subject Headings:* **1. Weather control legislation 2. California.**—*G.T.*

**11M–232** 551.509.617

Campbell, Ivan J., **Now they're seeding the clouds.** *Cotton Gin and Oil Mill Press*, Dallas, Texas, 52(7):9–10, March 31, **1951. DA** (304.8 C822)—The prospects of success of the contract of ranches and farmers in Nueces, San Patricio and Jim Well Counties in the Coastal Bend area of Texas with Dr. Krick's organization are evaluated, considering effects of previous similar operations and the cautious attitude of the Weather Bureau. Dr. Krick's explanation of the theoretical and

practical conditions of operation is presented. *Subject Heading:* **1. Cloud seeding potentialities.** —*O.T.*

**11M–233** 551.5(023)

Cook, J. Gordon, **Can science stop it raining? Featuring the weather, with 10 other science stories for the non-technical reader.** *Spotlight on Science*, Guildford, Surrey, England, No. 2, **1951.** 58 p. Price: 2s. **DWB**—Half of the 16 chapters of this science booklet deal with meteorology or related subjects. The history of meteorology and weather forecasting, the climate of Great Britain, large-scale climatic changes, artificial control of precipitation, solar energy utilization and cosmic radiation are discussed in simple terms. (*Same item as* 5.1–11, Jan. 1954, *Met. Abs.*) *Subject Heading:* **1. Popular science books.**—*G.T.*

**11M–234** 551.509.617

Coons, Richard D. and Gunn, Ross, **Relation of artificial cloud-modification to the production of precipitation.** (In: **Compendium of Meteorology.** Boston, American Meteorological Society, **1951.** p. 235–241. 8 figs., 15 refs.) **DWB**—History of theory and practice of cloud seeding is reviewed, conditions necessary for successful artificial precipitation outlined, and Cloud Physics Project of U. S. Weather Bureau, NACA and USAF described. Results of 170 controlled tests made by the Project (1947–49) in Ohio, Calif. and Alabama are analyzed. Verification was by radar, aerial photography and voice recordings of observers' notes as well as by a ground network of rainfall stations and upper air soundings (rawinsondes). A few successful attempts are described but more often the careful analysis of records showed that the actual precipitation was induced by natural processes, whereas the dry-ice seeding inhibited the development of cumulonimbus. The conclusion is that seeding produces disappointing results from a commercial standpoint but promises to be of considerable scientific value. (*Same item as* 6J–54, Oct. 1955, *Met. Abs.*) (For fuller abstract *see item* 4.2–2, Feb. 1953, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding effects 2. U. S. Weather Bureau Cloud Physics Project.**—*M.R.*

**11M–235** 551.509.617(676)

*Davies, D. A.; Hepburn, D. and Sansom, H. W., **Report on experiments at Kongwa on artificial stimulation of rain, Jan.–April, 1951.** *East Africa High Commission. Meteorological Department, Memoirs*, 2(9), **1951.** 31 p. diagrs., charts, bibliog. Price: 5/s. **DWB**—An area of 200 sq mi near Kongwa in Central Tanganyika, with a close network of 50 evenly spaced standard (5 in.) rain gages, was used to test the efficiency of silver iodide seeding techniques. Local pilot balloon observations, hourly records of clouds and weather conditions, and general synoptic conditions were considered for the seven periods during Jan.–April **1951.** Two methods were used: 1) standard charcoal burner at ground level and 2) exploding AgI impregnated gunpowder at the freezing level (15,000 ft) in cumulus clouds. Conditions during each trial are carefully described and the results summarized statistically. More attempts were unsuccessful than conclusively successful, but there was good evidence, based on 2 rain gages, that much of the rain stimulated fell outside of the test area, that more rain was stimulated by the balloon-bomb technique than by the ground generator method; and that attempts should be made in the future to avoid overseeding or delayed seeding. Furthermore, no upper air temperatures were available to determine exact height of freezing level. Whether or not seeding was responsible, crops were better in this area than in the two preceding years. Diagrams show location of rain gages, details of equipment and isohyets for several of the periods in relation to point of release of bombs. (*Same item as* 3.8–68 and 6J–55, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding techniques 2. Cloud seeding with silver iodide 3. Cloud seeding in East Africa 4. Kongwa, Tanganyika. I. East Africa High Commission. Meteorological Dept.**—*M.R.*

**11M–236** 551.509.617:546.57:546.15

Deering, Ferdie J., **Spring floods have followed winter drought; how much increase resulted from cloud seeding?** *Farmer-Stockman*, Oklahoma City, 54(7):9, 30, July **1951.** 1 fig., a.a. on p. 9. **DA** (6OK45)—Large scale cloud seeding with silver iodide particles is sponsored by farmers and stockmen, with positive results thus far. The question of how successful it is in avoiding drought depends on additional rainfall over a longer period. The process of silver iodide seeding by ground generator is illustrated. *Subject Headings:* **1. Cloud seeding effects 2. Cloud seeding with silver iodide.**—*O.T.*

**11M–237** 551.509.617:551.576.1

Dessens, H., **A la recherche d'une technique antigrêle.** [Searching for a hail control technique.] *Phytoma*, Paris, No. 32:18–20, Nov. **1951.** photo., diagr. **DA.** Also issued as *Puy de Dôme. Observatoire, Publications, Ser. B.*, No. 6, **1951.** 6 p. Mimeog. **DWB**—Describes laboratory experiments indicating the possible effectiveness of AgI nuclei for hail prevention by means of over-

seeding. Preliminary (not unfavorable) results of experiments recently started in the Pyreness by means of six AgI generators are reported. (*Same item as* 6J 56, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Hail prevention in France 2. Cloud seeding with silver iodide 3. Overseeding with silver iodide.**—*G.T.*

**11M–238** 551.509.617:551.578.7(44)

Dessens, Henri (*Dir. Puy-de-Dôme Obs.*), **Les Pyrénées, laboratoire de météorologie expérimentale.** [The Pyrenees, laboratory of experimental meteorology.] *Pyrénées*, No. 7, [1951]. 4 p. Stamped on title page: *Puy-de-Dôme. Observatoire, Publications, Ser. B*, No. 4, **1951.** Abstracted from reprint. **DWB**—In this preliminary account of an artificial rain making and hail prevention project sponsored by the Regional Commission of anti-hail technical research of southwestern France and the Electrical Administration of France, experiments carried on with AgI generated on the ground and with salt crystals introduced into clouds from stations at high altitudes (1800–2900 m) are reported. The experiments were based on theories and results reported by American scientists, especially those connected with Project Cirrus. It is pointed out that no final conclusions can be drawn at this early stage of the enterprise. A few experiments are described but no conclusive evidence is offered. (*Same item as* 4.1–70, Jan. 1953, *Met. Abs.*) *Subject Headings:* **1. Hail prevention in France 2. Artificial precipitation 3. Silver iodide smoke generators 4. Cloud seeding in Pyrenees 5. Pyrenees 6. Southwestern France.**—*G.T.*

**11M–239** 551.509.617

Dightman, R. A., **Rainmaking proven or experimental?** *Montana Farmer-Stockman*, 38(14):7, 18, March 15, **1951. DA** (6 M764)—Stressing the importance of analysis and the need for more research, cloud dissipation, silver iodide and probable precipitation are examined. The official position of the Weather Bureau is quoted which does not hold that artificial rainmaking is impossible. Although experiments justify more work, it has not been demonstrated yet that production of rainfall in sufficient amounts is commercially sound. *Subject Headings:* **1. Cloud seeding studies.**—*O.T.*

**11M–240** 551.509.617

Elliott, Robert D., **Increasing precipitation through cloud seeding.** *Weatherwise*, 4(4):88–90, Aug. **1951.** 4 figs. **DLC**—A simple description of the BERGERON-FINDEISEN theory of rain formation and of the mode of action of seeding with silver iodide in producing and increasing precipitation. The manner of introducing silver iodide into clouds to reproduce most effective results, the effect of overseeding and the size of the area over which precipitation is increased by seeding are discussed. (*Same item as* 3.3-73, March 1952, *Met. Abs.*) *Subject Headings:* **1. Bergeron-Findeisen theory 2. Cloud seeding with silver iodide.**—*I.L.D.*

**11M–241** 551.509.617:551.578.7

Facy, L., **Que faut-il penser de la lutte contre la grêle?** [What should we think of hail control?] *Phytoma*, Paris, No. 26:19–20, May **1951.** Also: Dehoey, —, **Extrait d'une communication.** [Summary of a communication on hail control.] *Ibid.*, p. 20–21. **DA**—FACY stresses the need for further research into the mechanism of hail formation, but nevertheless states that introduction of a large number of nuclei into a cloud before the formation of hailstones begins would decrease the probability of hailfall. DEHOEY examines and rejects the possibility of an effect of purely explosive rockets on hail formation. (*Same item as* 6J 58, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Hail prevention 2. Overseeding.**—*G.T.*

**11M–242** 551.509.617(09)

Fleming, Roscoe, **Man-made weather.** *Montana Farmer-Stockman*, 38(13):1, 9, 20, Mar. 1, **1951.** 3 figs. **DA**—A survey of seeding operations is presented, illustrated by a sketch of ground generator operation, and pictures of cirrus clouds and of a produced rain shower. VINCENT SCHAEFER's basic discovery on supercooled clouds in 1946, and the contributions of BERNARD VONNEGUT, IRVING LANGMUIR, Project Cirrus and IRVING P. KRICK are discussed. Problems of drought, hail and lightning control are considered. Project Cirrus, E. J. WORKMAN's project at New Mexico School of Mines and Colorado's plan for legislative action are mentioned. *Subject Headings:* **1. Cloud seeding projects 2. Progress in cloud seeding.**—*O.T.*

**11M–243** 551.509.617(78/79)

Friggens, Paul, **Can the rain makers regulate the weather?** *Farm Journal*, March **1951.** p. 34–35, 100, 102, 103, 104. figs. **DA**—Efforts to make rain in the semiarid regions of the west are described and numerous instances of successful cloud seeding experiments by using silver iodide smoke are cited—especially the work done under contract by IRVING P. KRICK. Extravagant claims of some rain-making operators are repudiated and objections from those who claim excessive rain or diversion of rain from other areas is harmful, are counterbalanced by the ultra-conservative view-

point of official organizations, making it appear that KRICK's position is rational and "scientific." (*Same item as* 3.3–74, March 1952, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with silver iodide 2. Western U. S.**—*M.R.*

**11M–244** 551.577.1 551.509.617

Gabites, J. F., **The formation of rain by natural and artificial processes.** *New Zealand. Meteorological Office, Circular Note,* No. 77, Oct. 24, **1951.** 9 p. refs. p. 8–9. **DWB**—The physical processes believed to lead to the formation of rain are described according to current hypotheses. An estimate is made of the relative effectiveness of the different processes. The possibilities of artificial stimulation of rainfall in New Zealand are discussed. (*Same item as* 6F–107, June 1955, *Met. Abs.*) *Subject Headings:* **1. Precipitation formation 2. Artificial precipitation.**—*Author's abstract.*

**11M–245** 551.576.1

Garrigue, Hubert, **Prospection aérologique et observations sur la pluie.** [Aerological sampling and observations of rain.] *Académie des Sciences, Paris, Comptes Rendus,* 233(3):267–268, July 16, **1951. DWB**—A brief note summarizing the main findings at the Puy-de-Dôme station and by airplanes flying through clouds of various types in the Clermont-Ferrand, Puy-de-Dôme and Vichy-Sancy regions. Height, temperature, cloud type, degree of ionization (1–3) and nature of cloud particles were reported. It is concluded that clouds with temperatures above 0°C produce rain, either naturally or artificially, and clouds with a temperature about −10°C produce ice particles. (*Same item as* 3.6–137 and 6F–108, *Met. Abs*) *Subject Headings:* **1. Cloud physics 2. Precipitation formation 3. France.**—*M.R.*

**11M–246** 551.510.7:551.574.1:551.509.617

Garrigue, Hubert, **Recherches sur la radioactivité de l'air libre.** [Research on the radioactivity of free air.] *Académie des Sciences, Paris, Comptes Rendus,* 233(16):860–862, Oct. 15, **1951.** refs. **DWB**—Data obtained through measurements from the ground and in flight for the period March through May 1951 are presented and claimed to confirm the existence of a complex radioactive particle for a period of several hours, which had been anticipated as early as in 1946. For the first time this particle could be observed from the ground. Other data chosen from the period 1946 through 1951 are arranged with a view to proving that the abundant precipitation lately noticeable over France (and definitely claimed by the author to be the result of condensation nuclei emerging from atomic explosions) washed out radioactive particles from the lower atmosphere. Artificial precipitation is suggested as a possible means of defense against air pollution from radioactivity. (*Same item as* 4.6–240, June 1953, *Met. Abs.*) *Subject Headings:* **1. Radioactivity in the atmosphere 2. Air sampling and analysis 3. Condensation nuclei 4. Artificial precipitation.**—*G.T.*

**11M–247** 551.509.617

Gaviola, Enrique, **Sobre provocación artificial de la lluvia, prevención del granizo y balance hídrico regional.** [Artificial precipitation, hail prevention and the regional water balance.] *Ciencia e Investigación,* Buenos Aires, 7(12):531–542, Dec. **1951.** 3 figs., table, 8 refs. **DA**—This lecture is based on the author's own research into the mechanisms of rain formation, icing and hail formation, and on results obtained by the scientists of General Electric Research Laboratory. In connection with the theory of artificial precipitation the decisive role of convection is stressed. Problems of regional water balance as determined by dynamic and humidity conditions of the atmosphere are considered. (*Same item as* 6J–59, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud physics 2. Artificial precipitation 3. Atmospheric water balance.**—*G.T.*

**11M–248** 551.509.617(83)

Gayan, S. C., **Lluvias artificiales.** [Artificial rainfall.] *Agrario,* Santiago di Chile, 15(423): 7–8, 28 April **1951.** 1 fig. **DA** (9.3 Ag85)—The physical process of natural rain formation, laboratory research and the application of its results to experiments on artificial precipitation in the United States are reviewed, referring to LANGMUIR and to IRVING KRICK. Although the experiments did not yet result in definite achievements, the physical and climatological conditions of Chile seem favorable for cloud seeding. *Subject Headings:* **1. Cloud seeding experiments 2. Chile.**—*O.T.*

**11M–249** 551.509.617

Hall, W. Ferguson; Emmons, Gardner; Haurwitz, Bernhard et al., **Dr. Langmuir's article on precipitation control.** *Science,* 113(2929):189–192, Feb. 16, **1951. DLC**—Criticism is levelled at LANGMUIR'S conclusion that the silver iodide seeded in tests carried out by him in New Mexico in 1948 and 1949 produced all of the rain in that state on the days of the seeding (*see item* 6J–35). In the opinion of the critics, LANGMUIR erroneously assumed that the distribution of rainfall is purely random and that adjacent areas are independent of one another, that he failed to consider the normal rainfall pattern before concluding that the correlation between the rainfall pattern on the days of

seeding was higher than normal and that he has not demonstrated satisfactorily that the occurrence of rainfall coincided with the distribution of silver iodide in areas beyond the center of silver iodide generation. Moreover, it is contended that from purely physical reasoning, it is impossible to deduce conclusively the meteorological processes resulting from silver iodide introduction in the atmosphere and that the time of effectiveness of silver iodide has not been determined. (*Same item as* 2.9–51 and 6J–60, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding effects 2. Langmuir, Irving.**—*I.L.D.*

**11M–250** 551.509.617:517.512.2

Hall, W. Ferguson (*U. S. W. B., Wash., D. C.*), **An evaluation of the technique of cloud seeding to date.** Washington, D. C., U. S. Weather Bureau, [1951]. 8 p. 4 figs. "Presented at New York Academy of Science, Oct. 23, 1951." **DWB**—Statistical tests of 7-day periodicities in precipitation, pressure differences across the Gulf Coast, temperature at 700 mb level over Omaha and other parameters which were found to have high correlation coefficients during the first phase of Project Cirrus' 7-day seeding by silver iodide at Socorro, N. Mex. (Dec. 1949–June 1951), show that equally high correlation coefficients have occurred frequently in the past 10 to 50 years. (*Same item as* 6J–61, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with silver iodide 2. Cloud seeding periodicities 3. Socorro, New Mexico 4. Project Cirrus.**—*M.R.*

**11M–251** 551.509.617:551.574.1

Houghton, Henry G., **An appraisal of cloud seeding as a means of increasing precipitation.** *American Meteorological Society, Bulletin,* 32(2):39–46, Feb. **1951.** 8 refs. **DWB**—A review of recent attempts to produce precipitation by artificial seeding of clouds, and the scientific basis for results or lack of results in various individual cases. The thermodynamic effects, the use of artificial versus natural nuclei, the seeding of clouds already precipitating and possible large-scale effects are considered. It is concluded that under certain conditions precipitation may be induced at an earlier stage than would occur naturally, but that no large-scale effects are likely. (*Same item as* 2.9–52 and 6J–62, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Cloud seeding.**—*M.R.*

**11M–252** 551.574.1:551.575:551.578.71

†Houghton, Henry G. (*M. I. T.*), **On the physics of clouds and precipitation.** (In: **Compendium of Meteorology.** Boston, American Meteorological Society, **1951.** p. 165–181. fig., 4 tables, 58 refs.) **DWB**—A thorough and lucid discussion of the particular phase of physical meteorology which deals with the physical processes of natural (as distinguished from artificial) condensation and precipitation. The source, physical and chemical properties, size and frequency distribution, and role of condensation nuclei in the initial phase of condensation, the growth of cloud drops; the methods of measurement of drop size and liquid water content, and data from such measurements; the physical processes of supercooling of water and water vapor, condensation and sublimation below 0°C, precipitation mechanisms, processes of snow, hail and ice cloud formation, size of raindrops and, finally, the artificial dissipation of fog are taken up in successive chapters or paragraphs. The most important literature on these subjects is included in the excellent bibliography, and the contributions of various authors in each field are cited and evaluated historically. Three methods of artificial fog dissipation are described (heating, desiccation and use of charged sand). The first two methods actually require about ten times as much energy as the theoretical minimum. Further research is needed to reduce this uneconomical factor. Also knowledge of the ice phase, of the role of freezing and sublimation nuclei, and of the growth of drops by collision in a gravitational field, which can be studied intensively in the laboratory and in the free atmosphere, are reviewed. (*Same item as* 3.11–4 and 6F–369, *Met. Abs.*) *Subject Headings:* **1. Cloud physics 2. Artificial fog dissipation 3. Hail formation 4. Ice phase.**—*M.R.*

**11M–253** 551.575:551.509.615(798)

Hutchison, Dale H. (*Stanford Research Inst.*), **Preliminary survey of ice fog in the Alaskan area.** Stanford Research Institute, Contract AF 19(122)-634, Final Report, Nov. 1, **1951.** 37 p. 8 figs., 6 tables, bibliog. p. 36–37. **DWB**—Ice fogs with low visibility—a serious factor in polar aviation—are caused mainly by human activity. The conditions necessary are: temperature −30°F or lower, wind speed 3 mph or less and an adequate supply of water vapor in the air. Maximal occurrence in the morning hours. The frequency of ice fogs increases rapidly with decreasing temperature and reaches 70–80% at −50°F. An artificial dissipation of supercooled fog and ice fog by means of silver iodide was tried out without definite results. Abstracts of U. S. A. F. reports dealing with ice fogs are given. (*Same item as* 9.10–53, Oct. 1958, *Met. Abs.*) *Subject Headings:* **1. Ice fog 2. Visibility 3. Silver iodide fog dissipation 4. Alaska. I. Wood, Charles P.**—*A.A.*

**11M–254** 551.574.1:551.509.617:548.5

Inn, Edward C. T., **Photolytic inactivation of ice-forming silver iodide nuclei.** *American Meteorological Society, Bulletin,* 32(4):132–136, April **1951.** 6 refs. **DWB**—Silver iodide crystals

are decomposed photolytically by the action of light having wave lengths below 4300 A. Photolysis is reversible when crystals are exposed to subdued light. Exposure of AgI nuclei to wave lengths, 4300 A and less, of a quartz mercury arc light source for 10–20 minutes destroys their capacity to form ice particles when injected into a cloud of supercooled water droplets. Exposure of photolyzed AgI nuclei to subdued light in a darkened room either did not bring about complete recovery from photolysis or had no effect at all. It is suggested that the surface-structure-sensitive process of ice nucleation by AgI is destroyed when the entire surface layer has been decomposed photolytically. (*Same item as* 3.8–137, Aug. 1952, *Met. Abs.*) *Subject Heading:* **1. Silver iodide decay.**—*I.L.D.*

**11M–255** 551.509.617

Israel. Rainfall Research Committee, **Symposium on artificial rain.** Hakirya, Aug. **1951.** 80 p. figs., refs. In Hebrew; English summaries. **DWB**—A collection of papers presented at the first scientific meeting held under the sponsorship of the Rainfall Research Committee after the first year's efforts (April 16–17, 1950), in an attempt to review progress and define problems slated to be solved. Papers directly related to cloud seeding operations are abstracted under items 6J–66 and 6J–87, *Met. Abs.* The foreword was written by Y. CARMON, head of the Rainfall Research Committee. (*Same item as* 5.4–71 and 6J 63, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Symposia 3. Israel. I. Zahavy, D. (ed.) II. Carmon, Y.**—*M.R.*

**11M–256** 551.509.617:546.264(794)

Jurwitz, Louis R., **Additional comments on the artificial inducement of precipitation.** *Arizona Cattlelog*, 6(5):22–23, Jan. **1951. DA** (43.8 Ar42)—The Weather Bureau analyzing claims of various rainmakers, among them DR. LANGMUIR'S, of producing heavy rains in New Mexico and the results of dry ice seeding tests of the California Electric Power Company over the Bishop Creek, California watershed on the eastern slopes of the Sierras, asserts that many carefully controlled field experiments and laboratory tests are needed to prove beyond doubt the success of such experiments. *Subject Headings:* **1. Cloud seeding with dry ice 2. Cloud seeding experiments 3. Bishop Creek, California.** —*O.T.*

**11M–257** 551.509.617

Kastens, Merritt L., **Weather to order.** *Chemical and Engineering News*, Wash., D. C., 29(12): 1090–1093, March 19, **1951.** photos, tables. **DWB.** Transl. with title: **Alteración a voluntad del estado del tiempo.** *Scientia*, Valparaiso, Chile, 18(4):252–256, Dec. **1951. DLC**—A major part of this review of cloud seeding is devoted to the history of experiments conducted at General Electric Research Lab. After giving an account of these and of other attempts, the author concludes that artificial rainmaking seems to be more feasible on a broad regional basis than over a closely limited area. Legislative action taken by U. S. Congress in connection with rainmaking is discussed. (*Same item as* 4.9–57, Sept. 1953, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Cloud seeding effectiveness.**—*G.T.*

**11M–258** 551.509.617:551.578.46(788)

Krick, Irving P. (*Pasadena, Calif.*), **Snow pack increase in the Colorado Rockies by artificial nucleation.** *Western Snow Conference, 19th Annual Meeting, Victoria, B. C., April 1951, Proceedings*, pub. July **1951.** p. 108–110. table. **DWB**—An attempt to increase snow pack was begun in Nov. 1950 in the upper Arkansas River Basin, and in other watersheds of Colorado from Jan. through April 1951. Silver iodide was used in all experiments. Success of method used evaluated by showing ratio of precipitation to water content of snow pack at Aspen, Colorado, for 1940–1950 and for Feb. 1, March 1 and April 1, 1951 showing record (or almost record) conditions for 1951. (*Same item as* 3.5–98 and 6J–65, *Met. Abs.*) *Subject Headings:* **1. Artificial snow pack 2. Cloud seeding with silver iodide 3. Colorado.**—*M.R.*

**11M–259** 551.509.617(569.4)

Krown, L., **Meteorological aspects of stimulating artificial precipitation in Israel.** (In: Israel. Rainfall Research Committee, **Symposium on artificial rain.** Hakirya, Aug. **1951.** p. 56–59. 5 refs. In Hebrew, English summary p. 15–16.) **DWB**—Meteorological conditions and extent of seeding necessary for the production of artificial rain and the results of 14 cloud seeding experiments in Israel are summarized. (*Same item as* 3.11–88 and 6J–66, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Israel 2. Israel.**—*I.L.D.*

**11M–260** 551.577.36:551.509.617(789)

Langmuir, Irving, **Cause and effect versus probability in shower production.** General Electric Research Laboratory, Schenectady, Contract DA-36-039-15345, Project Cirrus, Final Report, July 30, **1951.** p. 228–231. 3 eqs. Also issued as its Occasional Report, No. 22, July 15, **1950. DWB**—A brief report attempting to show that rainfall in New Mexico is not a result of cause and effect

(which would mean that every shower could be forecast quantitatively) but of probability. This probability is increased by synoptic conditions, number of condensation nuclei, temperature, lapse rate, water vapor content, etc. The average rainfall and number of stations reporting on July 3 and 10, 1949 given as proof of theory. Several formulas are presented for calculating the probability as affected by sublimation nuclei concentration. (*Same item as* 3.1–136, 3.4–198 and 6J–67, *Met. Abs.*) *Subject Headings:* **1. Rainfall probability 2. Cloud seeding 3. Sublimation nuclei 4. New Mexico.**—*M.R.*

**11M–261** 551.509.617:551.577.11(789)

Langmuir, Irving, **Cloud seeding by means of dry ice, silver iodide, and sodium chloride.** *New York Academy of Science, Transactions*, Ser. 2, 14(1):40–44, Nov. **1951.** 4 tables. **DWB**—The theory of precipitation formation and cloud seeding developed during recent years is summarized by the leading research scientist in this field. Effects of various cloud seeding experiments are discussed with special emphasis on the controversial experiments with silver iodide on Oct. 14, 1948 and July 21, 1949 in New Mexico, and on regular weekly silver iodide seedings in New Mexico started in Dec. 1949 and carried on for several months. The results of these periodic experiments are analyzed in terms of comparative precipitation and upper air temperature data which are found to show a definite periodicity following the rhythm of the experiments. (*Same item as* 3.10–88 and 6J–68, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding 2. Cloud seeding in New Mexico 3. Rainfall periodicities 4. Upper air temperatures 5. New Mexico.**—*G.T.*

**11M–262** 551.509.617(789)

Langmuir, Irving, **Progress in cloud modification by Project Cirrus.** General Electric Research Laboratory, Contract DA-36-039-sc 15345, Project Cirrus, Final Report, Schenectady, July 30, **1951.** p. 204–227. 2 figs., 2 tables, 4 eqs. **DWB**—Development of rain from cumulus clouds is deduced from hearing effect following the forming of ice crystals. By artificially introducing ice into the cloud the forming of ice crystals is claimed to be set off through chain reaction, if the artificial seeding is done under a proper synoptic situation and adequate concentration of sublimation nuclei. Introducing high concentrations of ice nuclei (overseeding) said to be best method to produce dissipation of large cumuli. Experiments by Project Cirrus in New Mexico in 1948 and 1949 mentioned as indicating that seeding increases the probability of rainfall. Statistical data presented *in extenso*. (*Same item as* 3.3–75 and 6J–69, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with dry ice 2. Cloud seeding in New Mexico 3. Project Cirrus 4. New Mexico.**—*G.T.*

**11M–263** 551.509.617(789)

Langmuir, Irving, **Results of the seeding of cumulus clouds in New Mexico. A partial report on flight 45.** General Electric Research Laboratory, Contract DA-36-039-sc-15345. Project Cirrus, Final Report, Schenectady, July 30, **1951.** p. 259–278. 8 figs., table. **DWB**—A brief discussion of the same subject was given by author in a paper presented before the American Meteorological Society on Jan. 5, 1949. The present report refers to a letter of HARRY WEXLER from the U. S. Weather Bureau, received by the author, and rejects the suggestion that the seeding under discussion had no obvious effect on the resulting rain, which would have occurred anyway. Eight photographs are added to the report on the flight which included one seeding with silver iodide and three with dry ice. (*Same item as* 3.3–76 and 6J–70, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding effects 2. Cloud seeding in New Mexico 3. Cloud photographs 4. New Mexico. I. Wexler, Harry.**—*G.T.*

**11M–264** 551.509.617(728.3)

Langmuir, Irving, **Studies of tropical clouds.** General Electric Research Laboratory, Contract DA-36-039-sc-15345, Project Cirrus, Final Report, Schenectady, July 30, **1951.** p. 279–295. **DWB**—Author found cloud formations in Honduras during the dry season to be particularly suited for seeding studies. Cooperating with JOE SILVERTHORNE of the United Fruit Company he carried out several experiments using single ice pellets, water or carbon dioxide both for stimulating and preventing rainfall. Several new techniques were introduced and tried out. Particularly good results are claimed to have been obtained from seeding with single pellets which are reported to have profoundly modified clouds. Motion pictures were made of unusual cloud formations and were used to study growth of cumulus when seeded or not seeded. Water scoop measurements made by plane are described. (*Same item as* 6J–71, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding techniques 2. Cloud seeding in Honduras 3. Cloud photographs 4. Honduras.**—*G.T.*

**11M–265** 551.509.617(969)

Leopold, Luna B. and Mordy, Wendell, A., **1948–1949 trials of the Schaefer-Langmuir cloud-seeding technique in Hawaii.** *Tellus*, Stockholm 3(1):44–52, Feb. **1951.** 3 tables, 7 refs. **DWB**—During 1948 and 1949 dry ice cloud seeding tests were made on six days over Lanai and on nine days over Molokai Island. The results are tabulated with great detail as to meteorological conditions,

time, amount of $CO_2$ dropped, height and thickness of clouds, height and temperature of release and of cloud tops and rainfall (if any) as recorded at a fairly dense network of stations. During days when seeding occurred there was a higher frequency of heavy rains than on non-seeding days, and the heaviest rains seemed to be associated with sub-freezing cloud tops. (*Same item as* 3.1–64 and 6J-72, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Hawaii 2. Hawaiian Islands.**—*M.R.*

**11M–266** 551.509.617 551.574.1

Ludlam, F. H., **Structure of shower clouds.** *Nature*, London, 167(4242):254–256, Feb. 17, **1951.** fig., 4 refs. **DWB**—Describes results of further examination of growth of droplets and crystals in cumulus. Growth of a droplet is slow for radius below 30$\mu$ but increases rapidly above that radius, proportional to its velocity relative to smaller drops, concentration of liquid water and density of droplet distribution. In many clouds large droplets, rather than ice crystals, cause the bulk of the precipitation. Graph shows growth of large droplets in cloud with base at 900 mb and 10°C. Author suggests that the most generally profitable procedure in rain-making would be spraying large droplets or large hygroscopic nuclei into cloud base. (*Same item as* 2.6–94, June 1951, *Met. Abs.*) *Subject Headings:* **1. Cloud physics 2. Artificial precipitation.**

**11M–267** 551.509.617

Mann, Dick, **I'd like to order a good rain.** *Kansas Farmer*, Topeka, 88(4):8, 36–37, 17 Feb. **1951.** 6 figs. **DA** (6 K13)—Surveys various experiments, as those of Krick's Water Resources Development Corporation in eastern Washington, New Mexico and Colorado; "Project Cirrus, and Wallace Howell's for the depleted New York water supply; their evaluation by an official committee of the AMERICAN METEOROLOGICAL SOCIETY and HARRY WEXLER'S report on experimental operations of the U. S. Weather Bureau with its 170 cloud-seeding flights in Ohio, California and the Gulf Coast from January, 1948 to June, 1949. More tests are seen to be needed for the determination of how much of the rain is natural and how much possibly induced by seeding. A diagram shows the process of seeding by ground generators. Photographs of a ground generator in operation are among the illustrations. *Subject Headings:* **1. Cloud seeding experiments 2. Cloud seeding effectiveness.** —*O.T.*

**11M–268** 551.509.617(764)

Martin, Ramon, **Panhandler farmers and ranchers disagree on merits of cloud seeding program.** *Farmer-Stockman*, Oklahoma City, 54(9):11, 20, 37, 45, Sept. **1951.** 10 figs. **DA** (6 OK45)—A popular report of the controversies on artificial precipitation. The prospects for cloud seeding are more favorable for **1952** in consequence of the experiences of 1951. Some law-suits are expected if rainfall increases greatly. Pictures of the inside of a cloud seeding generator and of a typical brimming Panhandle lake are among the illustrations. *Subject Headings:* **1. Cloud seeding effects 2. Cloud seeding projects 3. Texas.**—*O.T.*

**11M–269** 551.578.7 551.578.41 551.574.1

†Mason, Basil John and Ludlam, F. H., **The microphysics of clouds.** *Physical Society of London, Reports on Progress in Physics*, 14:147–195, **1951.** 9 figs., 14 plates, 5 tables, 71 refs., 14 eqs. **DLC**—An exhaustive summary of the voluminous recent literature. Spontaneous condensation of pure water vapor requires supersaturation of about 400%. Authors discuss mode of action, nature, numbers and radii of condensation nuclei. Growth of droplets in cloud and fog is considered, from direct and indirect determinations of cloud droplet sizes and comparison with theories of SCHUMANN, HOWELL and LANGMUIR. Sec. 5 deals with experiments on initial stages of ice formation—freezing and sublimation nuclei, supercooling, etc. The formation of ice crystals and snow flakes is considered in relation to cloud types and the formation and growth of hailstones including problem of multiple layers are discussed. Finally, the development of precipitation is analyzed, the efficiency of chain reactions emphasized, and a brief consideration given to artificial precipitation. (*Same item as* 3.3–173 and 6F-131, *Met. Abs.*) *Subject Headings:* **1. Cloud physics 2. Raindrop coalescence 3. Snow crystal formation 4. Hail formation.**—*C.E.P.B.*

**11M–270** 551.577.11:551.509.617

Mason, B. J., **Natural and artificial production of atmospheric precipitation.** *Nature*, London, 168(4274):533–534, Sept. 29, **1951.** **DWB**—Summary of discussion at British Association, Edinburgh, Aug. 10, 1951, including contributions by B. J. MASON; F. H. LUDLAM; R. F. JONES; A. B. BREWER and I. C. BROWNE. (*Same item as* 3.3-79, March 1952, *Met. Abs.*) *Subject Heading:* **1. Precipitation physics.**—*C.E.P.B.*

**11M–271** 551,578.11:551.509.617

Mason, B. J., **The physics of precipitation and the artificial production of rain.** *Advancement of Science*, London, 8(31):308–309, Dec. **1951.** **DLC**—Opens with a brief account of various mecha-

nisms for natural production of rain—large droplets; ice crystals and supercooled droplets; falling ice crystals. Then describes artificial stimulation by ice crystals or silver iodide, and refers to limitations of methods. (*Same item as* 3.8–153, Aug. 1952, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Raindrop formation.**—*C.E.P.B.*

**11M–272** 551.509.617(787)

*Miller, W. McNab and Varineau, Verne J. (*both, Wyoming Agric. Exper. Sta.*), **Verification studies of commercial cloud seeding operations in Wyoming for the period May 1, 1951 through Sept. 30, 1951.** *Wyoming. Agricultural Experiment Station, Mimeograph Circular*, No. 8, Nov. **1951.** 19 p. fig., 8 tables. **DWB**—A study of precipitation records for 1921–1950 for selected stations in target and control areas of Wyoming shows the magnitude of the year-to-year and place-to-place variations in departures from normal. Hence, evaluation of the precipitation data obtained during 1951 seeding operations can only indicate that a possible effect of seeding ranging from −15.5% to +71.4% occurred. Month-by-month data for each year from 1921 to 1950 and for 1951 are presented for May, June, July, Aug. and Sept. and for the 5 month average for NE, SE and NW seeding areas and for SW Wyoming control areas and for interregional comparisons. (*Same item as* 8.5–68, May 1957, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding evaluation 2. Artificial precipitation 3. Precipitation data 4. Wyoming.**—*M.R.*

**11M–273** 551.509.617:551.574.1

Neumann, H., **Silver iodide as a cloud seeding agent.** (In: Israel. Rainfall Research Committee, **Symposium on artificial rain.** Hakirya, Aug. **1951.** p. 24–29. 7 refs. In Hebrew, English summary p. 9–10.) **DWB**—WEGENER'S, FINDEISEN'S and BERGERON'S theory of colloidal instability of supercooled clouds, SCHAEFER'S work of inducing artificially ice crystals in a supercooled cloud and CWILONG and VONNEGUT'S experiments with AgI are discussed. The results of experiments using a colloidal water suspension of AgI introduced into a cloud chamber (home freezer) are described. (*Same item as* 4.1–72, Jan. 1953, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Cloud seeding with silver iodide.**—*I.L.D.*

**11M–274** 551.574.1:551.594.7

Neumann, J., **Radar in cloud research.** (In: Israel. Rainfall Research Committee, **Symposium on artificial rain.** Hakirya, Aug. **1951.** p. 40–47. 7 figs., 18 refs. In Hebrew. English summary p. 12–13.) **DWB**—A discussion of RAYLEIGH'S theory of the scattering of electromagnetic radiation by spherical particles and of its relevance to radar and the application of radar to cloud research, to cloud physics studies and to experiments on artificial rainfall. (*Same item as* 3.11–181 and 6G–56, *Met. Abs.*) *Subject Headings:* **1. Cloud physics 2. Artificial precipitation 3. Radar cloud research.** —*I.L.D.*

**11M–275** 551.509.617

Pearce, R. P. and Eldridge, R. H., **Weather control.** *Weather*, 6(5):157, May **1951. DWB**—Letter on the unpredictable eventuality that local interference with weather may have wide repercussions. (*Same item as* 2.9–54, Sept. 1951, *Met. Abs.*) *Subject Heading:* **1. Artificial precipitation.** —*C.E.P.B.*

**11M 276** 551.509.617(68)

Pulvermacher, Keith, **Artificial rain in South Africa.** *Discovery*, London, 12(7):219–220, July **1951.** photo. **DA**—Reports cloud seeding experiments carried out in 1948, 1949 and 1950 by the South African Council for Scientific and Industrial Research. Although evidence produced by the experiments is not conclusive, the results achieved with ground-based silver iodide generators appear to be promising. (*Same item as* 6J–73, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in South Africa 2. Union of South Africa.**—*G.T.*

**11M–277** 551.501.45:551.578.1:551.509.617(788)

Resnick, Sol D. (*Colo. Agr. Exp. Sta., Ft. Collins*), **Analysis of climatological data for the spring cloud seeding period over North Central Colorado; preliminary report.** Fort Collins, Colorado Agricultural Research Foundation, July **1951.** 11 p. **DWB**—A statistical study was made of precipitation over the target area and a control area (1911–1951), snow pack over target and control area (1938–51) and the general rainfall pattern over the area west of the Mississippi. Results indicate that on control area 62% of normal precipitation occurred, whereas on target area only 52% of normal (March) fall. Snow water content in control area in March and April 1951 was 147%, and on target area 158% of 13 year normal. Snow pack increase is attributed to low temperatures. No improvement was seen, either in comparison with normal or with other areas of the west, as a result of seeding operations. (*Same item as* 4.4–81 and 6J–74, *Met. Abs.*) *Subject Headings:*

**1. Precipitation data analysis 2. Cloud seeding in Colorado 3. Colorado. I. Colorado Agricultural Experiment Station, Fort Collins II. Northern Colorado Natural Resources Association.**—*M.R.*

**11M–278** 551.574.1:551.521.11

Reynolds, S. E., Hume, Wm., II; Vonnegut, Bernard and Schaefer, Vincent J., **Effect of sunlight on the action of silver iodide particles as sublimation nuclei.** *American Meteorological Society, Bulletin*, 32(2):47, Feb. **1951.** **DWB**—Short wave radiation, such as from sunlight, was found to increase the deterioration of silver iodide particles from that in dark of one order of magnitude in 24 hours, to two orders of magnitude in one hour. These results obtained in open air at Socorro, New Mexico, were duplicated in laboratory (with use uf UV lamp) at Schenectady, N. Y. (*Same item as* 2.9–120, Sept. 1951, *Met. Abs.*) *Subject Headings:* **1. Sublimation nuclei 2. Silver iodide nuclei 3. Radiation effects.**—*M.R.*

**11M–279** 551.509.617(54)

Roy, A. K., **Rain-making and its possibilities in India.** *Indian Journal of Meteorology and Geophysics*, Delhi, 2(4):241–249, Oct. **1951.** 2 figs., 6 refs. **DWB**—A nontechnical account of the present position of rain making. Discussion of physical conditions for rain making in India, where clouds are rarely suitable for seeding. Therefore, from the practical point of view, the scope of rain making in India seems to be strictly limited. Includes explanations for rainless areas in India during a rainstorm. (*Same item as* 3.5–100, May 1952, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in India 2. India.**—*A.A.*

**11M–280** 551.576.11:629.13

Schaefer, Vincent J., **Localized effects induced by seeding supercooled clouds with dry ice and silver iodide.** *Western Snow Conference, 19th Annual Meeting, Victoria, B. C., April 1951, Proceedings*, Pub. July 1951. p. I–XI. 20 refs. **DWB**—Author discusses seeding of clear air, stratus clouds, and cumulus clouds, over-seeding, and natural seeding including several recent experiments which proved successful from a scientific point of view. Seeding of clear areas produced large masses of fine ice crystals under certain conditions. When exhaust trails were being formed behind the plane, seeding of the clear air did not change the situation one way or another. Ice crystals found in vapor trails consisted of "small hexagonal columns and clustered columns which may have formed on frozen water drops from the condensation trails." (*Same item as* 2I–133 and 6J–75, *Met. Abs.*) *Subject Headings:* **1. Condensation trails 2. Cloud seeding effects.**—*M.R.*

**11M–281** 551.509.617

Schaefer, Vincent J. (*Assignor to General Electric Co., New York*), **Method of crystal formation and precipitation.** *U. S. Patent Office, Patent* No. 2,570,867, Oct. 9, **1951.** [3 p.] refs. **DP.** Also: **Rain-making method is now patented.** *Science Digest*, 31(1):94, Jan. **1952.** **DLC**—The application for this patent was filed on Jan. 21, 1948. The document contains a detailed description of a method for producing minute crystals or nuclei in aerosols comprising supercooled liquid droplets, by seeding with a substance (such as dry ice) and thus producing zones of low temperature (such as −39°C). The note in *Science Digest* sums up the essential points of the invention. (*Same item as* 6J–76, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding patents 2. Patents.**—*G.T.*

**11M–282** 551.509.617:551.574.1

Schaefer, Vincent J., **Snow and its relationship to experimental meteorology.** (In: **Compendium of Meteorology.** Boston, American Meteorological Society, **1951.** p. 221–234. 17 figs., table, 43 refs.) **DWB**—The many and varied and often beautiful forms in which snow or ice may occur in nature are discussed and nicely illustrated, and the methods of preserving and photographing such forms or crystals mentioned. Seeding in nature (from Ci clouds or spontaneous freezing in supercooled clouds) and the time required for ice forms to fall, liquid water content of stratus or cumulus clouds, freezing nuclei and condensation nuclei necessary for precipitation, electrical properties of snow and charges in snow clouds, factors affecting supercooled clouds and, finally, the use of dry ice, silver iodide and other seeding methods to control weather: induce or prevent precipitation, snow, hail, thunderstorms, to dissipate clouds are adequately discussed and illustrated. Limitations to success in seeding are outlined but the outlook described as hopeful for both scientific and practical purposes under certain specified and limited conditions. (*Same item as* 4.1–7 and 6J–77, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding 2. Cloud physics 3. Weather control.**—*M.R.*

**11M–283** 551.509.617:551.577.3

Schwerdtfeger, Werner, **Consideraciones acerca de la compensación global de la precipitación anual, en relación con el problema de la producción artificial de lluvias.** [Consideration on the global compensation of annual precipitation in relation to the problem of artificial production of rainfall.]

*Meteoros*, Buenos Aires, 1(2-3):189–197, June **1951**. 2 tables, 8 refs. Spanish and English summaries p. 189. **DWB**—Data on variations of rainfall over large and small areas; as compiled by Tannehill for the United States, the Mississippi Valley and Texas, show that variations over the largest area range from +13% to −15%, and over the smaller area of Texas to as much as +49% and −47% of normal in the wettest and driest areas respectively. This, the author claims, is proof of "compensation," or of the fact that if rain is excessive in one place it must be deficient in another. Works of C. E. P. BROOKS are cited in respect to rainfall over the globe, and BERGERON'S ideas on artificial rainfall vs. those of LANGMUIR and SCHAEFFER are reviewed. It is the author's opinion that in spite of compensation, useful additional rainfall over certain critical land areas could be produced at the expense of oceanic areas-thus not robbing other land areas while achieving economically profitable results. As further proof that this process operates in the Argentine, a statistical study is necessary. Lacking a synoptic climatic calendar such as BAUR proposed for Europe from 80 years of record, the data for 1901 to 1940 for March, April and May (120 months) for the Falkland Islands (Cape Pembroke) were analyzed by dividing the array into four groups of 30 cases each, according to anomalies of pressure. The simultaneous rainfall amounts east of Rio Negro and at Malvinas for each group show that when rainfall is above normal at one, it is below normal at the other place. (*Same item as* 3C–229, March 1952, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Global precipitation compensation 3. Annual rainfall variations.**—*M.R.*

**11M–284** 551.577.2:551.509.617

Schwerdtfeger, Werner, **Gedanken überein Ausgleichs-Prinzip des atmosphärischen Gesamt-Niederschlages.** [Idea on a compensating principle for total atmospheric precipitation.] *Meteorologische Rundschau*, 4(5/6):96–97, May/June **1951**. German and English summaries p. 96. **DWB**—Author argues that the total annual precipitation over the globe is determined entirely by the incoming solar energy and is therefore nearly constant from year to year. Consequently, an artificial increase of precipitation in one region can only be obtained at the expense of a decrease in some other region. (*Same item as* 2.11–145 and 6J 78, *Met. Abs.*) *Subject Headings:* **1. Precipitation distribution 2. Artificial precipitation.**—*C.E.P.B.*

**11M–285** 551.509.617:551.582.1(459.1)

†Serra, Antonio, **La provocazione artificiale delle precipitazioni e sua possibilita di applicazione in Sardegna.** [Artificial inducement of precipitation and its possible application in Sardinia.] *Rivista di Meteorologia Aeronautica*, 11(3/4):3–17, July/Dec. **1951**. 3 figs., 2 tables, 40 refs. Italian, French, English and German summaries p. 3. **DWB**—The article begins with an extensive review of early attempts at artificial production of precipitation and studies of cloud physics, and progress in this field of applied meteorology since 1946. Laboratory and field experiments in the U. S., Canada, Hawaii, France, Australia and South Africa are also reviewed and evaluated. The second part of the article deals with general climatic conditions in Sardinia, orographic influences, prevailing air flow, and frequencies of winds of various speeds from different directions in several parts of the island in relation to rainfall, and finally, the implications for experiments in artificial rain production. (*Same item as* 4.4–83 and 6J–79, *Met. Abs.*) *Subject Headings:* **1. Weather control 2. Wind variations 3. Rainfall variations 4. Cloud seeding in Sardinia 5. Sardinia, Italy.**—*M.R.*

**11M–286** 551.509.616/7(410)

Shellard, H. C. and Grant, D. R., **Results of an artificial nucleation experiment.** *Meteorological Magazine*, 80(951):253–255, Sept. **1951**. 4 photos. **DWB**—St. Cu. at 9000–9500 ft over S.E. England, March 9, 1951, was seeded with dry ice along three lines. Clear lanes developed and merged and a wind shear occurred. Visual and radar photos given. Some snow fell in small flakes. (*Same item as* 3.3–72, March 1952; and 6J–80, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding effects 2. Cloud seeding with dry ice 3. England.**—*C.E.P.B.*

**11M–287** 551.574.1:551.577.11

Sheppard, P. A., **The physics of clouds and their precipitation.** *Endeavour*, London, 10(38):89–94, April **1951**. 4 figs., 12 refs. **DLC**—A concise, nontechnical summary of the physics of cloud formation and their precipitation. The various theories on the growth of cloud droplets are discussed and evidence indicating that clouds are generally stable colloids is presented. The work of FOURNIER D'ALBE, FINDEISEN and of MASON on the formation of ice clouds and BERGERON'S theory of precipitation and artificial precipitation are discussed. (*Same item as* 2.9–121 and 6F–141, *Met. Abs.*) *Subject Headings:* **1. Cloud physics 2. Precipitation formation.**—*I.L.D.*

**11M–288** 551.577.1

Steinitz, G., **Problems of rain formation.** (In: Israel. Rainfall Research Committee, **Symposium on artificial rain.** Hakirya, Aug. **1951**. p. 19–23. 16 refs. In Hebrew, English summary

p. 8–9.) **DWB**—The role of condensation in cloud particles in rain formations, collision and direct condensation as factors in rain formation and the Bergeron-Findeisen theory are discussed. (*Same item as* 3.11–195, Nov. 1952, *Met. Abs.*) *Subject Heading:* **1. Rain formation.**—*I.L.D.*

**11M–289** 551.509.617:551.508.99(789)

Swearingen, Tom, **Turn on the rain.** *Record Stockman*, (Annual Edition 1951), 61(52):234–238, Dec. 28, **1950.** 4 figs. **DA** (49 D43)—A successful operation of IRVING P. KRICK'S Corporation with 300–400% rain above the normal in July–August 1950 in New Mexico with smoothing out of rainstorms is reported, admitting such operations to be experimental according to KRICK himself. A closeup of a portable silver iodide generator is among the pictures. *Subject Headings:* **1. Cloud seeding experiments 2. Silver iodide smoke generators 3. New Mexico.**—*O.T.*

**11M–290** 551.509.617

U. S. Congress. Senate. Committee on Interior and Insular Affairs, **Weather control and augmented potable water supply. Joint Hearings before Subcommittee of the Committees. 82nd Congress, first session on S.5 . . . S.222 and S.789.** Wash., D. C., Govt. Print. Off., **1951.** 353 p. figs., maps, charts, refs. **DLC**—A voluminous compilation of prepared statements, impromptu testimony and discussions of the scientific, commercial and legal aspects of rain making by $CO_2$ or AgI seeding of clouds and of other methods of increasing water supply, presented as transactions of the hearings which took place between March 14–19 and April 5, 1951 in Washington. Among those who testified at some length were W. F. MCDONALD of the U. S. Weather Bureau, PROF. HOUGHTON and NEUBERGER, WALLACE HOWELL, IRVING KRICK, VINCENT SCHAEFER and BERNARD VONNEGUT. The purpose of the bill is to establish federal control over rain making activities. (*Same item as* 3.5–103 and 6J–82, *Met. Abs.*) *Subject Headings:* **1. Weather control legislation 2. Water supply 3. Congressional hearings on weather control. I. U. S. Congress. Senate. Committee on Interstate and Foreign Commerce II. U. S. Congress. Senate. Committee on Agriculture and Forestry III. Anderson, Clinton P.**—*M.R.*

**11M–291** 551.509.617(611)

Violante, G., **Bilan des essais de pluie artificielle effectués et contrôlés par la Météorologie Nationale en Tunisie.** [Summary of artificial precipitation experiments carried out and evaluated by the French Météorological Service in Tunisia.] *Almanach Agricole Tunisien*, 1952:278–286. Pub. **1951. DA**—In Tunisia 31 cloud seeding operations have been carried out by airplane since March 1948. Various seeding agents were used. Clouds connected with cold fronts were seeded on 21 occasions and yielded precipitation in 60% of the cases. Precipitation also occurred from the 2 thunderclouds seeded and from 40% of the other clouds treated. It is believed that Tunisia is favorable for cloud-seeding operations. (*Same item as* 6J–83, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Tunisia 2. Tunisia.**—*G.T.*

**11M–292** 551.509.617(941)

Vollprecht, R., **Artificial rain.** *Weather*, 6(10):317, Oct. **1951. DWB**—Brief account of a shower caused by a scrub fire in Western Australia. (*Same item as* 3.3–81, March 1952, *Met. Abs.*) *Subject Headings:* **1. Brush fire cloud formation 2. Western Australia.**—*C.E.P.B*

**11M–293** 551.574.11:551.509.617

Vonnegut, Bernard and Neubauer, Raymond, **Recent experiments on the effect of ultraviolet light on silver iodide nuclei.** *American Meteorological Society, Bulletin*, 32(9):356, Nov. **1951.** 2 refs. **DWB**—Experiments have been carried out in which AgI smoke produced by burning impregnated charcoal was placed in a box with ultraviolet light in the center. It was found that during each hour the concentration of active ice forming nuclei in the smoke decreased exponentially. In other experiments the concentration was found to decrease to 30°/$_c$–50°/$_c$ per hour. These results are in marked contrast to the previously published data which indicated 10°/$_c$ to 1°/$_c$ remaining concentration at the end of one hour. It is probable that the effect of sunlight on the AgI is greatly influenced by traces of certain impurities either in the atmosphere or in nuclei. (*Same item as* 6I–26, Sept. 1955, *Met. Abs.*) *Subject Headings:* **1. Silver iodide nuclei 2. Artificial nuclei production 3. Nuclei and radiation 4. Nuclei decay 5. Nuclei experiments.**—*N.A.S.*

**11M–294** 551.509.617(789)

Warren, Leslie A., **The practical aspects of cloud seeding as a means of causing or increasing precipitation.** *Rio Grande Water Forecast Committee, Annual Meeting 2nd, April* 13, 1951, *Proceedings*, Sept. **1951.** p. 8–13. **DWB**—Beginning with a statement of the official attitude of the Chief of the U. S. Weather Bureau in regard to the present status of rain making experiments by cloud seeding, the author goes on to quote several current opinions by research workers on both sides of the controversy including statements by HENRY G. HOUGHTON, WILLIAM LEWIS and VINCENT SCHAEFER.

Exaggerated claims of success are discounted and the belief expressed that the possibilities will be known only after years of controlled tests in the field. (*Same item as* 3.5–106 and 6J–84, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding 2. New Mexico. I. U. S. Weather Bureau.**—*M.R.*

**11M–295** 551.509.617:551.577.11

Wexler, Harry, **Precipitation: natural and otherwise.** Washington, D. C., U. S. Weather Bureau, Sept. 20, **1951.** 12 p. 2 figs. **DWB**—In this speech given before the American Society of Agricultural Engineers at Houston, Texas, WEXLER describes in a lucid manner the status of experiments on artificial rainfall production in the United States and the theoretical basis for such tentative conclusions as may now be made. The difficulty in drawing conclusions regarding the practical value of single attempts or of a series of attempts at rainfall stimulation stem from the extreme natural variability of rainfall in both time and space and the difficulty in predicting rainfall from a single storm. (*Same item as* 3.5–107 and 6J–85, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding evaluation. I. U. S. Weather Bureau.**—*M.R.*

**11M–296** 551.574.2:551.509.616(747)

Woodman, Charles A. and Langmuir, Irving, **A gamma pattern seeding of stratus clouds, flight 52 and a race track pattern seeding of stratus clouds, flight 53.** General Electric Research Laboratory, Contract DA-36-039-sc-15345, Project DA 3-90-08-022, Project Cirrus, Final Report, July 30, **1951.** p. 232–258. 10 figs. **DWB**—A detailed description of two dry ice cloud seeding flights following certain patterns on Nov. 24, 1948 near Schenectady, N. Y., is given, including weather conditions, process of flights, methods applied and results. The effect of the seedings in dispersing clouds along the course seeded, claimed to be spectacular, is shown in pictures taken after the seeding had been completed. (*Same item as* 3.4–189 and 6J–86, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with dry ice 2. Artificial cloud dispersal 3. Cloud photographies 4. New York.** —*G.T.*

**11M–297** 551.509.617(569.4)

Zahavy, D., **Recent developments.** (In: Israel. Rainfall Research Committee, **Symposium on artificial rain.** Hakirya, Aug. **1951.** p. 60–63. 8 refs. In Hebrew, English summary p. 16–17.) **DWB**—VONNEGUT's AgI seeding experiments and the attitude of the American Meteorological Society towards rain making experiments are discussed briefly. Smoke generating activities from the ground were carried out in Israel in 1950–1951. Preliminary results indicate rainfall increase in the largest area. A single smoke generating operation from aircraft underneath a cumulus cloud was followed by heavy rainfall. (*Same item as* 4.1–73, Jan. 1953, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Silver iodide smoke 3. American Meteorological Society 4. Israel.** —*I.L.D.*

**11M–298** 551.509.617:551.574.2(569.4)

Zahavy, D., **Survey of research and experiments in artificial rain making.** (In: Israel. Rainfall Research Committee, **Symposium on artificial rain.** Hakirya, Aug. **1951.** p. 49–55. 23 refs. In Hebrew; English summary p. 13–14.) Also his: **Recent developments.** *Ibid.*, p. 60–63. 8 refs. English summary p. 16–17. **DWB**—Description of the basic ideas on rain formation, discussion of the action of AgI and of ice crystals in producing artificial rainfall and of the relationship of amount and type of precipitation to type of seeded clouds. VONNEGUT's AgI seeding experiments and the attitude of the American Meteorological Society towards rain making experiments are discussed briefly. Smoke generating activities from the ground were carried out in Israel in 1950–1951. Preliminary results indicate rainfall increase in the largest area. A single smoke generating operation from aircraft underneath a cumulus cloud was followed by heavy rainfall. (*Same item as* 4.1–73, 4.1–74 and 6J–87, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Israel 2. Artificial precipitation 3. Israel.**—*I.L.D.*

**11M–299** 551.509.617:344(794)

**Artificial rainmaking experiments continue over even-widening areas.** *Engineering News-Record*, 147(14):46, Oct. 4, **1951. DLC, DWB**—Brief news article mentioning new laws for regulating rainmaking in California and appropriations for experiments in California and the Columbia Basin. (*Same item as* 4.4–78, April 1953, *Met. Abs.*) *Subject Headings:* **1. Weather control legislation 2. Western States 3. United States.**—*M.R.*

**11M–300** 551.509.617:546.264

**Basic method of artificial rainmaking now patented.** *Science News Letter*, Wash., D. C., 60(16): 249, Oct. 20, **1951. DLC**—A brief note reporting that patent 2,570,867 was issued to DR. VINCENT SCHAEFER of Schenectady, N. Y., for his artificial technique of rainmaking by forming crystals of

ice in supercooled clouds by the use of particles of dry ice dropped through them (*see* 11M–281). Patent rights were assigned to General Electric Company which sponsored the research. *Subject Headings:* **1. Cloud seeding patents 2. Cloud seeding with dry ice.**—*I.S.*

**11M–301** 551.509.617:551.508.91

**Catch "illegal" rainmaking.** *Science News Letter*, Wash., D. C., 59(17):269, April 28, **1951. DLC**—A brief note about DR. BERNARD VONNEGUT'S efforts to develop instruments which would make it possible to count the number of nuclei in the air. This gadget reportedly would help the detection of illegal rainmaking. *Subject Headings:* **1. Weather control legislation 2. Nuclei counters.** —*I.S.*

**11M–302** 551.509.617(73)

**Cloud seeding and U. S. weather.** *South African Journal of Science*, 48(4):137, Nov. **1951. DLC**—A definite seven-day cycle of rain and other weather phenomena last year is thought by Dr. IRVING LANGMUIR to have resulted from the weekly cloud seeding in New Mexico which might possibly have "triggered" a periodic oscillation in pressure or other weather elements. (*Same item as* 4.2–67, Feb. 1953, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding periodicities 2. United States.** —*M.P.K.*

**11M–303** 551.509.617

**Control of rainmaking.** *Science News Letter*, 59(12):182, March 24, **1951. DLC.** Also: **Weather control remote.** *Ibid.*, 59(13):198, March 31, **1951. DLC**—A brief summary of the testimony presented before Senate subcommittees, considering bills which would place research and control in rainmaking in the Federal Government. The U. S. Weather Bureau argued against strict control by the Government. The Interior Department and private scientists advocated such control. (*Same item as* 2.9–50, Sept. 1951, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Weather control hearings.**—*I.L.D.*

**11M–304** 551.509.617

**L'ensemencement des nuages.** [Cloud seeding.] *Atomes*, Paris, 6(66):310, Sept. **1951. DLC**—Brief discussion of cloud seeding of means of silver iodide and two other nucleating agents: (1) sulfur trioxide seeded from an airplane at the rate of 4 kg per hr over 250 km, and yielding 5 to 10 times as much rain as AgI and (2) calcium chloride. One of the benefits of cloud seeding is seen in that frequent light rain is obtained instead of violent thundershowers. Successful cloud seeding will raise the engineering problem of constructing inexpensive dams and reservoirs in order to conserve the water obtained. (*Same item as* 6J–57, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with silver iodide 2. Cloud seeding with sulfur trioxide 3. Cloud seeding with calcium chloride.** —*G.T.*

**11M–305** 551.509.617

**Federal rainmaking.** *Time*, 58(15):56, Oct. 8, **1951. DLC**—The U. S. Government announced by Under Secretary of the Interior RICHARD D. SEARLES that notwithstanding Weather Bureau's skepticism the Toonneville Power Authority will start cloud seeding in the forest and mountain areas over northeastern Washington and northern Idaho, under contract with the Water Resources Development Corporation. MR. SEARLES believes that the experiments produced 12,000 extra acre-feet of water in Arizona in 1948. If the project of about $50,000 is successful the additional water sent down the Columbia River will be worth $200,000 to $500,000 in electric power alone. *Subject Heading:* **1. Cloud seeding projects.**—*O.T.*

**11M–306** 551.5:06 551.501.81:551.509.617

**Meteorology at the British Association meeting in Edinburgh, Aug. 1951.** *Weather*, 6(11):338–339, Nov. **1951. DWB**—Brief summaries of papers presented at the meeting: Paton, J., **Auroras and luminous night clouds.** Jones, R. F., **Radar echoes from precipitation.** Mason, B. J.; Brewer, A. W. and Browne, I. C., [Discussion on] **Natural and artificial production of atmospheric precipitation.** (*Same item as* 3.4–16 and 6G–55, *Met. Abs.*) *Subject Headings:* **1. Conferences 2. Luminescent clouds 3. Radar precipitation echoes 4. Artificial precipitation.**—*C.E.P.B.*

**11M–307** 551.509.617:357

**No rain-making curbs.** *Science News Letter*, Wash., D. C., 60(16):253, Oct. 20, **1951. DLC**—A brief note about a proposed congressional bill which allows the rainmaking industry to operate and grow for another two years without control or licensing. This bill, however, is not in accordance with the recommendations of the American Meteorological Society which declared licensing by the Federal Government to be desirable. *Subject Heading:* **1. Weather control legislation.**—*I.S.*

11M–308 551.509.617

North American Weather Consultants, **Facts about increasing precipitation through cloud seeding.** Pasadena, Calif., Jan. **1951.** 6 p. 4 figs. **DLC**—A brief discussion of the salient points in cloud seeding techniques, written for popular consumption. Paragraphs on cloud physics, dry ice seeding, silver iodide seeding, natural nuclei, effects of over-seeding, results achieved by seeding thus far, amount of moisture robbed from areas downwind, formation of clouds by seeding, and difficulty in evaluating results without long and careful statistical checks, are included along with schematic diagrams. (*Same item as* 2.9–53, Sept. 1951, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding techniques.**—*M.R.*

11M–309 551.577.1 551.509.617(04)

**Rain formation.** *Science and Culture*, 16(8):365, Feb. **1951. DWB**—Summarizes briefly two lectures on natural and artificial precipitation in Australia, delivered by E. S. BOWEN before the Indian Association for the Cultivation of Science at Calcutta. (*Same item as* 2.8–110, Aug. 1951, *Met. Abs.*) *Subject Headings:* **1. Precipitation formation 2. Artificial precipitation 3. Addresses 4. Australia.**

11M–310 551.509.617

**Rain making.** *Current Science*, Bangalore, 20(1):12, Jan. **1951. DLC**—An abstract of a lecture delivered by S. K. BANERJI. The silver iodide method is described briefly. (*Same item as* 2.9–55, Sept. 1951, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding with silver iodide.**

11M–311 551.509.617(94)

**Rainmaking in Australia.** *Research*, London, 4(11):526, Nov. **1951. DLC**—This note refers to silver iodide cloud seeding experiments which are being carried out by the C.S.I.R.O. in the Riverina district of New South Wales. It is pointed out that earlier experiments throughout the world have not yet proved the usefulness of artificial rainmaking and that it will take some time before sufficient data can be collected in present experiments to serve as such proof. (*Same item as* 4.4–80, April 1953, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Australia 2. Australia.**—*G.T.*

11M–312 551.509.617:551.521.1:551.574.1

**Sunlight spoils particles.** *Science News Letter*, 59(22):341, June 2, **1951. DWB**—A brief report on the findings of Edward C. Y. Inn that sunlight changes the shape of AgI crystals so that they lose their ice forming capacity. (*Same item as* 3.5–102 and 6I–23, *Met. Abs.*) *Subject Headings:* **1. Silver iodide decay 2. Ice crystal formation 3. Radiation effects.**—*I.L.D.*

11M–313 551.509.617(78/79)

**U. S. to probe rainmaking.** *Science News Letter*, 60(14):213, Oct. 6, **1951. DWB**—The U. S. Weather Bureau is planning to conduct a survey of the effectiveness of cloud seeding in producing artificial precipitation over 17 western states; California already has appropriated money for a study of the effects of cloud seeding. (*Same item as* 3.5–104, May 1952, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Cloud seeding evaluation 3. U. S. Weather Bureau 4. Western United States.**—*I.L.D.*

## 1952

11M–314 551.509.617(729.1)

American Institute of Aerological Research, Denver, Colo., **A report on cloud seeding potentialities in Central Cuba, American Sugar Refining Company, Cunagua & Jaronu.** *American Institute of Aerological Research, Denver, Report*, No. 70, March 25, **1952.** 23 p. 7 figs., 2 tables, 4 refs. **DLC**—A preliminary survey of climatic, orographic and other factors to be considered in planning cloud seeding operations for the benefit of the American Sugar Refining Corporation plantations in central Cuba. Relationship of rainfall (May–Oct.) to harvested cane, as shown in scatter diagrams, indicate 529–588 additional "arrobas per cab" for each additional inch of rain (range 25–50") at Cunagua and Jaronu, respectively. The basic cloud, precipitation, wind and weather patterns over Cuba are discussed. May through Oct. is recommended as most suitable season for ground AgI and occasional airplane seeding. Routine pilot balloon ascents and weather forecasts are required. Sites for most favorable location of generators are indicated. Motion picture cameras are needed for proving effectiveness. Seeding should be suspended during hurricanes. (*Same item as* 4.8–64 and 6J–88, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Cuba 2. Cuba. I. Water Resources Development Corporation.**—*M.R.*

11M–315 551.509.617(794)

§*Battle, John A.; Jones, W. Floyd and Todd, Clement, **Cloud-seeding experiments in the San Diego County and the Santa Ana River Watershed, Nov. 1, 1951 through April 15, 1952.** Rev. ed.

June 10, 1952. [Pub. by Santa Ana River Weather Corporation.] 142 p. 88 figs., 7 plates, tables, ref. p. 2. Also: **Supplement, Nov. 1, 1951, through April 15, 1952.** (Rev. ed.) Oct. 1, 1952. 7 p. tables, map. **DWB**—Statistical tests showed that about 20% more rain fell in the target area seeded by silver iodide particles than in a control zone. Chance of error 1:12 to 1:10,000. Statistical analysis is explained and actual data and scatter diagrams are given. Synoptic analysis of 2 single storms, made, using tropospheric winds (2000 to 18,000 ft) as well as aerological data. (*Same item as* 5.1–93 and 6J–89, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in California 2. Synoptic studies 3. San Diego County, Calif. 4. Santa Ana River, Calif. I. San Diego County Weather Corporation II. Santa Ana River Weather Corporation.**—*A.A.*

**11M–316** 551.509.617:551.578.46(795)

†Beaumont, R. T.; Work, Robert A.; Frost, W. T. and Barton, Manes, **Use of snow surveys in evaluating cloud-seeding operations.** *Western Snow Conference, 20th, Sacramento, Calif., April* 1952, *Proceedings.* pub. 1952. p. 56–72. 7 figs., 6 tables, 21 refs. **DWB**—Water content in snow on target and control areas, located in Oregon, is compared for 10–19 years of observation. The resulting correlation is 0.80 or higher. Cloud seeding activities in 1949–51 are summarized and precipitation maps are shown. No evidence for a positive effect of cloud-seeding was found, but on the contrary a statistically significant decrease of the water-equivalent in comparison with the normal climatic regime was computed. (*Same item as* 6J-90, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding evaluation 2. Snow surveys 3. Oregon.**—*A.A.*

**11M–317** 551.509.617(549.13)

Behrman, Daniel, **Is artificial rain possible in the parched lands of Baluchistan?** *United Nations Educational, Scientific and Cultural Organization, Courier,* 5(7):11, July 1952. 2 illus. **DWB**—Brief account of the activities of the Meteorological Department of the Government of Pakistan, which is supported by UNESCO. Particular attention is given to the research conducted by Edward Fournier d'Albe (London), UNESCO representative and cloud physicist at the Meteorological Station of Quetta. Purpose of his investigation is to determine possibilities of artificial stimulation of rain in Pakistan. The station is equipped with simple homemade instruments, including a cascade impactor. (*Same item as* 4.3-84 and 6J–91, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Pakistan 2. Arid zones 3. Baluchistan, Pakistan. I. Fournier d'Albe, Edward.** —*G.T.*

**11M–318** 551.509.617

Birstein, S. J. (*U. S. A. F., Cambridge Res. Ctr., Mass.*), **The effect of relative humidity on the nucleating properties of photolyzed silver iodide.** *American Meteorological Society, Bulletin,* 33(10): 431–434, Dec. 1952. 2 figs., table, 10 refs. **DWB, DLC**—Laboratory experiments on the effect of relative humidity or absorbed water vapor upon the photolysis and nucleating ability of AgI particles. In order to produce various degrees of relative humidity known amounts of water vapor are introduced into a stream of nitrogen passing over a AgI generator. The particles ranging from 0.004 to 0.4 micron were irradiated by UV for varying duration and injected into a cloud of supercooled water droplets. The results of experiments with varying degrees of relative humidity indicated that increasing relative humidity raises the resistance of AgI to destruction by UV light. A possible mechanism for the phenomenon is discussed. (*Same item as* 4.8-65 and 6J–92, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Cloud seeding with silver iodide 3. Cloud physics 4. Silver iodide properties.**—*I.L.D.*

**11M–319** 551.509.617

Blair, Richard, **Control of the weather.** *Discovery,* London, 13(4):113–114, April 1952. photo. **DLC**—In connection with recent weather control activities, the author discusses the effect of an increase or decrease in rainfall on the economic welfare of various regions throughout the world. He declares that while increasing precipitation would be vital for many regions, the reverse is the case for other areas. Guano production, the reduction of insects and diseases, the cultivation of certain fruits and crops and the tourist trade call for diminished rainfall. A photograph showing South African scientists at work with an AgI generator is added. (*Same item as* 6J-93, Oct. 1955, *Met. Abs.*) *Subject Heading:* **1. Weather control.**—*G.T.*

**11M–320** 551.509.617(85)

*Boucher, Roland J., **Evaluation of cloud seeding activities in Peru, Pt. A, Cerro de Pasco watershed, Sept. 1951–May 1952. Pt. B, Gildemeister watershed, Sept. 1951–June 1952.** Cambridge, Mass., Wallace E. Howell Assoc., Inc., Dec. 1952. 25+20 p. maps, figs., tables. **DWB**—Summaries of generator operation, cloud motions during seeding, precipitation amount within the watershed and in adjacent areas. Rainfall amount in target areas compared with control stations and with normal amounts, as well as river discharges in target area with control catchment areas. Sta-

tistical tests show positive effect of seeding in almost all cases, although with insufficient confidence limit. (*Same item as* 4.11–85 and 6J–94, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Peru 2. Cerro de Pasco watershed, Peru 3. Chicama-Moche watershed, Peru. I. Howell, Wallace E., Associates, Inc., Cambridge, Mass.**—*A.A.*

**11M–321** 551.509.617(94)

Bowen, E. G., **Australian experiments in artificial rain-making.** *American Meteorological Society, Bulletin*, 33(6):244–246, June **1952.** 4 refs. **DWB, DLC**—In this talk presented at a Weather Bureau Seminar, Washington, D. C., Nov. 7, 1951, BOWEN discussed the pitfalls standing in the way of the experimenter in artificial precipitation, the aim of Australian research on cloud seeding, and the results and achievements. The experiments, most of which were conducted with dry ice dropped into the tops of clouds from an airplane and the special cloud conditions under which operations were carried out, are described. Also silver iodide seeding experiments, weather conditions under which dry ice seeding may be of value and the spraying of warm clouds with water in order to induce coalescence are discussed. (*Same item as* 4D–259 and 6J–95, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding techniques 2. Cloud seeding in Australia 3. Australia.**—*I.L.D.*

**11M–322** 551.509.617(94)

Bowen, E. G., **Australian experiments on artificial stimulation of rainfall.** *Weather*, 7(7):204–209, July **1952.** 2 figs., 2 photos, 6 refs. Also issued (with slight changes) in: *Australian Institute of Agricultural Science, Journal*, 20(1):18–23, March **1954.** Also: **Australian experiments in rain-making.** *Current Science*, Bangalore, 24(5):143, May **1955. DLC**—About 100 experiments led to the conclusion that "given suitable cloud conditions, it is tolerably certain that seeding with dry ice produces rain which could not otherwise have fallen." These conditions are defined by cloud top temperature and cloud thickness. AgI requires lower temperature and is less effective. Water drop spraying is also promising. Limit of possible increase of rain in S.E. Australia 5–10%, but may be economically profitable in marginal wheat area. (The note in **Current Science** is a summary of the same information.) (*Same item as* 3.10–86 and 6J–96, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with dry ice 2. Cloud seeding with water 3. Cloud seeding in Australia 4. Australia.**—*C.E.P.B.*

**11M–323** 551.509.617(94)

Bowen, E. G., **A new method of stimulating convective clouds to produce rain and hail.** *Royal Meteorological Society, Quarterly Journal*, 78(335):37–45, Jan. **1952.** 5 figs., 2 tables, 5 refs. **Review** in: *Annalen der Meteorologie*, 5(1/2):45–46, **1952,** and in: *The Aeroplane*, London, 82(2117):182, Feb. 15, **1952. DWB**—Assuming that droplets, larger than existing natural ones but small enough to be carried up, will grow by coalescence, calculations show that droplets of diameter about 50$\mu$ introduced into base of a convective cloud will fall out after 20–60 min with a diameter more than 1 mm. Experiments with spraying from an aircraft were made at Sydney, Australia. In cloud less than 5000 ft thick, 6 produced virga of a few drops less than 0.5 mm and one had no result. In cloud more than 5000 ft thick, 1 light, 2 heavy and 1 very heavy showers occurred. In 8 of 11 cases the cloud dissipated. (*Same item as* 3.4–90 and 6J–97, *Met. Abs.*) *Subject Headings:* **1 Cloud seeding techniques 2. Cloud seeding in Australia 3. Sydney, Australia.**—*C.E.P.B.*

**11M–324** 551.509.617:519.24(791)

Brier, Glenn W. and Enger, Isadore (*U. S. W. B., Wash., D. C.*), **An analysis of the results of the 1951 cloud seeding operations in central Arizona.** *American Meteorological Society, Bulletin*, 33(5):208–210, May **1952.** 2 figs., 2 tables. **DLC, DWB**—An independent statistical analysis of the experiment of P. B. MACCREADY, JR. on cloud seeding in central Arizona during 1951 (*see* 11M–352). A more complete network of stations, more past data and slightly different statistical techniques were used. On the basis of a 31-year record, precipitation in the seeded area in 1951 was larger than normal; however the departure from the regression time was not significant, the t-test indicating 18 chances out of a 100 of obtaining a positive departure of this magnitude from the regression line. Adding more stations with at least 10 years of record gave a highly significant departure ($P<0.01$) for the 1951 value. Using only the last 10 years of data gave a probability of 0.08 (compared with 0.18 with 31-year record). The "significance of the result depends on both the network of stations and the length of record available. (*Same item as* 4.2–67 and 6J–98, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Arizona 2. Cloud seeding evaluation 3. Statistical techniques 4. Arizona. I. MacCready, P. B., Jr.**—*I.L.D.*

**11M–325** 551.509.617(944)

Campbell, Christie, **Seeding the clouds.** *Flying*, Chicago, 51(6):25, Dec. **1952.** 3 figs. **DLC**—The progress of rainmaking experiments in Australia is pictured, showing cumulus cloud boiling upward nine minutes after seeding with dry ice; four minutes later towering a mile higher and shredding

rain from its base; seven minutes still later, in anvil shape, still precipitating the only rain within a hundred mile radius over the Blue Mountains, New South Wales. An economic evaluation of the experiments is attempted. Silver iodide spraying from ground generators, radar and the employment of calculus are also considered. *Subject Headings:* **1. Artificial precipitation 2. Blue Mountains, New South Wales.**—*O.T.*

**11M–326** 551.509.617:711

Clawson, Marion (*Bureau of Land Management, U. S. Dept. Interior*). **Land use potentialities of artificially-induced precipitation in the western United States.** *Land Economics*, Madison, Wis., 28(1):54–62, Feb. **1952. DA**—Without attempting to decide the controversial issue of an efficacy or inefficacy of weather modification efforts, the author assumes that such efforts might, under some circumstances, increase the general precipitation amount over wide areas. Effects of such an eventual increase on the growth of various crops, on stream flow, on erosion, on land use, and on various programs are considered. (*Same item as* 6J–99, Oct. 1955. *Met. Abs.*) *Subject Headings:* **1. Effects of rainfall increase 2. Weather control benefits 3. Land utilization.**—*G.T.*

**11M–327** 551.509.617:551.578.7(45)

Consorzio Volontario Sperimentazione Lotta Antigrandine di Cenate. **Relazione sullo svolgimento dell'esperimento di difesa antigrandine attuato nell'anno 1950 . . . in provincia di Bergamo.** [Report on hail control experiments in Bergamo Province in 1950.] Bergamo [1951?] 45 p. diagr. maps. Also its: **Relazione sullo svolgimento della lotta contro la grandine nel suo secondo anno di esperimento in provincia di Bergamo.** [Report on the second year of hail control experiments in Bergamo Province.] Bergamo [1952?] 40 p. **DA**—These reports contain detailed accounts by the groups participating in the hail control activities of Bergamo Province in 1950 and 1951. Diaries of storms and operations, maps showing launching locations and synoptic situations, and quotations of newspaper articles are included. The results are summed up by GINO SARTORI, who was in charge of the project. The technique employed (explosive rockets) was found to be definitely successful, yet subject to further improvement. (*Same item as* 6J–100, Oct. 1955. *Met. Abs.*) *Subject Headings:* **1. Hail prevention in Italy 2. Bergamo Province, Italy. I. Sartori, Gino.**—*G.T.*

**11M–328** 551.509.617(678.2)

Davies, D. A., **Artificial stimulation of rain at Kongwa.** *Nature*, London, 167(4250):614–615, April 14, **1951** and 169(4311):1001–1002, June 14, **1952.** 2 refs. **DLC**—The first article describes two methods used in East Africa to produce particles of AgI by burning charcoal impregnated with acetone solution of AgI and by exploding small charges of impregnated gunpowder. The charges are carried by hydrogen balloons into suitable clouds and released at freezing level by time fuses. The second paper is an account of proposed experiments in which a mixture of particles of sea salt and calcium chloride is carried by balloon into nonfreezing clouds and scattered by explosion. (*Same items as* 3.5–97, 3.10–87 and 6J–101, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding techniques 2. Cloud seeding with silver iodide 3. Cloud seeding with salt 4. Cloud seeding in East Africa 5. Kongwa, Tanganyika.**—*C.E.P.B.*

**11M–329** 551.509.617(678.2)

Davies, D. A. (*E. African Met. Service*). **Artificial stimulation of rainfall** *South African Journal of Science*, Johannesburg, 49(2):45–48, Sept. **1952. DWB**—After a general survey of theoretical and experimental progress in cloud seeding, the author describes the experiments conducted at Kongwa, Tanganyika during the period Jan.–April 1951. In these experiments the "balloon-bomb" technique was applied, which involves the launching of hydrogen balloons carrying small charges of gunpowder to explode at an altitude of about 15,000 ft above mean sea level. By this method the seeding material is carried directly into the cloud, which is one of the advantages over the ground-generator technique. Effects of the seeding were observed over a network of 50 rain gages distributed over a 200 sq mi area. Out of 27 days when successful operations were expected, 12 were "probably unsuccessful," 10 "inconclusive" and only 5 "probably successful." The analysis of total rainfall data and their comparison with data from surrounding unseeded areas showed equally poor results. Further experiments with the "balloon-bomb" are in progress. (*Same item as* 4.8–68 and 6J–102, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in East Africa 2. Balloon bomb technique 3. Cloud seeding evaluation 4. Kongwa, Tanganyika.**—*G.T.*

**11M–330** 551.509.617:551.574.1(678.2)

*Davies, D. A.; Hepburn, D. and Sansom, H. W., **Report on experiments at Kongwa on artificial control of rainfall, Jan.–April 1952.** *East Africa High Commission. Meteorological Dept., Memoirs*, 2(10), **1952.** 14 p. 8 figs. (some fold.), 3 refs. (For Jan.–April 1951 Report, *see* 11M–235, *Met.*

*Abs.*) **DWB**—A series of rain-making experiments carried out at Kongwa, Tanganyika, during the period Jan. April 1952 are described and the results are presented in graphic form. Both AgI and hygroscopic particles in water drops consisting of sea salt and calcium chloride were used as seeding agents and their dispersal was effected by means of balloons. The theoretical basis for the use of hygroscopic particles to induce rainfall is discussed and the method of releasing the seeding agent, the preparation of the balloon charges for the AgI and hygroscopic mixtures, and the general weather conditions during the experiments are described. It was found: 1) "that on days when AgI and hygroscopic particles were released the total rainfall in the area of release, on both sets of days, was substantially less than on days when no experiments were conducted; the number of days in each of the three sets of days being the same, 2) on days when hygroscopic particles were released, the total area in the rainfall 6–12 mi downward from the area of release was substantially greater than the total rainfall in the same area on days when no experiments were conducted; and 3) in some cases the release of hygroscopic particles into small cumulus clouds resulted in their complete dispersal." (*Same item as* 8.6 167, June 1957, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Cloud seeding in East Africa. 3. Hygroscopic nuclei 4. Cloud seeding with silver iodide 5. Kongwa, Tanganyika.**—*I.L.D.*

**11M–331** 551.509.617:551.578.7

Dessens, Henri (*Puy-de-Dôme Obs.*), **Étude de quelques tentatives pour provoquer la pluie ou éviter la grêle.** [Study on some efforts to cause rain or to prevent hail.] *Société des Sciences Naturelles du Maroc, Comptes Rendus des Séances Mensuelles*, No. 3:71–72, **1952.** Stamped on t-p: *Puy-de-Dôme. Observatoire, Publications, Sér. B*, No. 5, **1952.** Abstracted from reprint. **DWB**—Note on cloud studies and rain making experiments conducted at Puy-de-Dôme Observatory. The note is based on a lecture delivered at a meeting of the Society of Natural Sciences of Morocco at Casablanca on March 7, 1952. The author compares the present state of the science of rain making to that of broadcasting in 1900. Chief difficulty is the lack of conclusive control methods. At the Observatory extensive use is made of photometric control techniques. Silver iodide cloud seeding experiments conducted so far appear to have had noticeable effects. A planned set-up of 20 generators is announced for hail prevention experiments to be conducted in 1952. (*Same item as* 4.8–69 and 6J–103, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Hail prevention.** —*G.T.*

**11M–332** 551.509.617(44)

Dessens, Henri (*Dir. Puy-de-Dôme Observatory*), **Études sur les orages Pyrénéens: deux campagnes d'insémination des nuages dans le Sud-Ouest.** [Studies on Pyrenees thunderstorms: two attempts at cloud seeding in the southwest.] *Puy-de-Dôme. Observatoire, Publication, Ser. B*, No. 1, 1953. 7 p. 2 figs. Reprint from: *Pyrénées* [Pub. by Puy-de-Dôme Observatoire], No. 12, Dec. **1952. DWB**—Report on the activity of the "Association for the Study of the Control of Weather Disasters" from 1951 to 1952. A broad program for S. France was planned in order to prevent hail storms and even to modify tropical storms. Laboratory studies in cloud physics were made, including methods to prevent coagulation. Field tests were rather disappointing. (*Same item as* 5.2–75 and 6J–104, *Met. Abs.*) *Subject Headings:* **1. Weather control 2. Cloud seeding in Pyrenees 3. Pyrenees, France.**—*A.A.*

**11M–333** 551.509.615/617

Dessens, Henri, **Sur la microstructure et la précipitation artificielle d'un brouillard surfondu.** [Microstructure and artificial precipitation of supercooled fog.] *Académie des Sciences, Paris, Comptes Rendus*, 235(25):1675–1678, Dec. 22, **1952.** 2 figs., 4 refs. **DLC**—In supercooled city fog having a temperature around −5°C widely spaced needles will form naturally without affecting the fog's stability. Precipitation was obtained from such fog over an area of 2 km² by the release of 100 gm silver iodide; the operation and results are described and quantitative data presented. (*Same item as* 6J–105, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Artificial fog dissipation 2. Supercooled fog 3. Cloud seeding with silver iodide.**—*Trans. of author's abstract.*

**11M–334** 551.509.617

Dufour, Louis, **Peut-on faire pleuvoir artificiellement?** [Can rain be made artificially?] *Ciel et Terre*, 68(9/10):187–195, Sept./Oct. **1952.** Also issued as: *Belgium. Institut Royal Météorologique, Publications, Ser. B*, No. 4, **1952. DLC**—Semipopular lecture on recent theories on cloud physics and on cloud seeding experiments conducted in various countries. The possibility of increasing precipitation by cloud seeding is not yet established, because the conditions favoring effective seeding are practically the same as those leading to natural precipitation. "Industrial" practice of rain-making is therefore a waste of money at this point. Author believes all such commercial efforts should be discouraged and instead funds should be made available to cloud physicists who alone are

likely to achieve positive results, even if success is not yet in view. (*Same item as* 4.10–84 and 6J 106, *Met. Abs.*) *Subject Heading:* **1. Artificial precipitation.**—*G.T.*

**11M–335** 551.509.617(78/79)

Elliott, Robert D. (*N. American Weather Consultants*), **Methods of evaluation in cloud seeding.** *Western Snow Conference, 20th Sacramento, California, April* 1952, *Proceedings*, p. 73–79, pub. **1952.** 3 figs., 4 refs. **DWB**—Snow course water contents and rainfall amounts are compared for control and target areas in the High Sierra, at San Diego and on the Bitteroot Mountains (Idaho). In practically all cases a positive effect of cloud seeding was found. (*Same item as* 5.5–74 and 6J–107, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding evaluation 2. Cloud seeding in Western U. S. 3. Western United States.**—*A.A.*

**11M–336** 551.509.6

Flohn, Hermann, **Künstliche Beeinflussung von Wetter und Klima?** [Artificial influencing of weather and climate?] *Geographische Rundschau*, 4(2):47–52, Feb. **1952.** 17 refs. **DLC**—This general article discusses the processes of rain formation and the possibility of causing it, the effect of great town fires during the war, atom bomb explosions, Russian hydrologic plans and effect of Gulf Stream. The possibility of large scale artificial changes of climate is minimized, though recent warming of Arctic may be partly due to $CO_2$ from coal burning. Artificial changes of local climate by towns, forests, etc. undoubtedly occur. (*Same item as* 4.3–83 and 6J–109, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Weather control.**—*C.E.P.B.*

**11M–337** 551.509.617(481)

Gotaas, Y. and Hoem, V., **Problemet kunstig regn.** [The problem of artificial rain.] *Naturen*, 76(7):206–220, **1952.** 4 refs. **DWB**—A popular presentation of theories, methods and chemicals as employed in cloud seeding research in the U. S., Australia and Europe. Author used fire extinguishers (containing carbonic acid which changes into carbon dioxide flakes of 1 mm in diameter upon passing through the narrow nozzle) with success in his cloud seeding experiments in Norway. However, like the experiments of other workers, evidence as to whether the observed precipitation that followed actually was caused by the seeding or by natural causes is an open question. Langmuir's experiments with seven-day periodical seeding are considered to be promising. (*Same item as* 4.9–55 and 6J–110, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Cloud seeding in Norway.**—*W.N.*

**11M–338** 551.509.6:34(73)

Guyer, E. H., **Weather control, Task Group Report.** A report by Task Group E-24, Weather Control, presented on May 7, 1952, at the Annual Conference, Kansas City. . . . *American Water Works Association, Baltimore, Journal*, 44(6):531–537, June **1952.** table, 7 refs. Photostat. **DWB**—General report on weather control, conducted in 20 of the 48 states. Legislation adopted by five states and has been considered by two others. Wyoming and Colorado already claim sovereignty to their atmospheric moisture. (*Same item as* 6J–111, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Weather control legislation 2. United States.**—*A.A.*

**11M–339** 551.509.617

†Hall, W. Ferguson (*U. S. W. B., Wash., D. C.*), **Status of possibilities of artificial precipitation.** *American Geophysical Union, Transactions*, 33(6):866–870, Dec. **1952.** 25 refs. **DWB, DLC**—Cloud seeding with dry ice or silver iodide is designed to increase the ice-crystal content of clouds containing supercooled liquid water droplets, and thereby to permit the growth of precipitation elements (snow-flakes or raindrops) by diffusion from water droplets to the induced ice crystals. Uncertainties as to need for additional ice crystals in clouds of appreciable water content make it difficult to estimate the potential value of cloud seeding in producing increased precipitation. Tests thus far have shown that it is often possible to produce slight amounts of precipitation from the bases of clouds, the rain reaching the ground on some occasions. Further research, both in the field and in the laboratory, will be needed to determine quantitatively the significance of cloud seeding in augmenting the nation's water resources. A short bibliography is furnished. (*Same item as* 4.9–56 and 6J–112, *Met. Abs.*) *Subject Heading:* **1. Artificial precipitation.**—*Author's abstract.*

**11M–340** 551.509.615

Harrison, Henry T. (*United Air Lines Weather Service*), **Results of 42 tests of Brandau-Kooser method of artificial fog dispersal (B-K Number 2).** United Air Lines, Inc., Sept. 2, **1952.** 9 p. 15 figs., tables, charts, photos. **DWB**—Report on tests "with a secret chemical" conducted during the period Nov. 18, 1950 to Nov. 24, 1951 by Harvey M. Brandau and Eugene K. Kooser of "Weather Control," Medford, under a contract with United Air Lines. The first 31 tests flown at

Medford and Arcata airports showed considerable results, while the last 11, at Portland airport, were utter failures and led to the discontinuation of the contract. Detailed evaluations of each test and cumulative data on weather elements and seeding results are presented in tables and charts. Three series of photographs illustrate fog dispersal. The method tested is judged "too uncertain in its present state of development to justify routine application for airline use." (*Same item as* 4.11–83 and 6J–113, *Met. Abs.*) *Subject Headings:* **1. Artificial fog dissipation. I. United Air Lines, Inc.**—*G.T.*

**11M–341** 551.509.61:34

Harvard Univ. Graduate School of Public Administration, **Regulation of weather modification activities.** A report prepared in the Seminar in Land Use and Conservation Graduate School of Public Administration, Harvard University. May **1952.** 50 p. **DWB**—The basis for the regulation of weather modification activities and the problems arising therefrom are examined from a strictly legal point of view. On the assumption that a Weather Control Committee has been established in accordance with the provision of the bill introduced by SEN. CLINTON F. ANDERSON in the 82nd Congress (S.222), the author examined the legal bases of the federal and state power to regulate weather modification; and outlined the proposed organization and proposed regulations of the U. S. Weather Control Committee. (*Same item as* 6.6–130 and 6J–114, *Met. Abs.*) *Subject Headings:* **1. Weather control legislation 2. U. S. Advisory Committee on Weather Control.**—*I.L.D.*

**11M–342** 551.574.1:551.509.617

†Havens, Barrington S. (*comp.*), (*Gen. Elect. Res. Lab.*), **History of Project Cirrus.** General Electric Research Laboratory, Schenectady, N. Y., Contract DA-36-039-sc-15345, Report, No. RL-756, July **1952.** 103 p. tables, 93 refs. p. 95–103. **DWB**—Covers the work of "General Electric" scientists in the "research study of cloud particles and cloud modifications," starting in 1940 (study of smoke particles) up to the establishment of Project Cirrus in Feb. 1947, and the activities under this contract up to its termination in 1952 (instrumentation, laboratory studies on ice nuclei, silver iodide, raindrops, condensation nuclei, electrical phenomena, etc., cirrus, stratus and cumulus studies, flight tests, hurricane and forest fire studies); actual discovery of the effect of dry ice or other cold materials on the nucleation of supercooled cloud particles in July 1946 by SCHAEFER, critical temperature for nucleation was found to be $-38.9°C \pm 0.1$; discovery of the effect of silver iodide smoke by VONNEGUT in the fall of 1946; theoretical calculations made by LANGMUIR; first cloud seeding on Nov. 13, 1946 (SCHAEFER); discovery of dry ice effects on clouds having temperatures above the freezing point (LEOPOLD and HALSTEAD 1947) which resulted in the rain chain reaction theory of LANGMUIR. (*Same item as* 6J–115, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding research 2. Project Cirrus. I. Langmuir, Irving II. Schaefer, Vincent J. III. Vonnegut, Bernard.**—*A.A.*

**11M–343** 551.577.33:551.509.617

Hawkins, H. F., Jr. (*Ext. Forecast Sec., U. S. W. B., Wash., D. C.*), **The weather and circulation of May 1952, including a study of some recent periodicities.** *Monthly Weather Review*, 80(5):82–87, May **1952.** 3 figs., 3 tables, 7 refs. **DWB**—Discussing a marked 7-day periodicity in precipitation amounts in May 1952 at Washington, D. C. and elsewhere in the eastern part of the U. S., the author mentions the fact that the May 1952 periodicity in Washington was greater than the one in April and May 1950. This latter has been claimed to be a result of periodic seeding. No periodic seeding was conducted in May 1952. (*Same item as* 6J–116, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Rainfall periodicities 2. Cloud seeding effects.**—*G.T.*

**11M–344** 551.509.617(729.1)

*§Howell, Wallace E., Associates, Inc., Cambridge, Mass., **Evaluation report of 1951 rainfall stimulation program for the Francisco Sugar Company.** [1952?] 40×44 cm unpaged. mostly charts (colored) with text, 8 tables. **DWB**—This de-luxe "atlas" presents the day by day results of the cloud seeding program conducted by HOWELL'S Company for the benefit of the Francisco Sugar Co. in the southeastern part of Camaguey Province, Cuba (south central coastal plains region of Cuba), during Aug.–Nov. 1951. Large full-page isohyetal charts in color based on data from 50 rain gages show the exact areas and amounts of precipitation which occurred in the region during each 24-hour period, and in addition, hodographs show the pilot balloon drift as an indication of the direction the silver iodide drifted from the generators. Radiosonde and surface synoptic data are also used in the summaries of daily meteorological conditions for the analyses which accompany each chart. A 29% total average increase of rain is claimed for the target area, above that on adjacent areas. (*Same item as* 5.8 83 and 6J–117, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Cuba 2. Camagüey Province, Cuba.**—*M.R.*

**11M–345** 551.509.617:551.577.2(71)

§Howell, Wallace E., Associates, Inc., Cambridge, Mass., **Evaluation report of the cloud seeding project in the Province of Quebec, October–December, 1951.** Cambridge, Mass., [1952]. 15 p. 2 tables, charts. **DWB**—A large and impressive presentation of the seeding activities, the meteorological conditions and the probable results of the seeding which was carried on in central Quebec by the Aluminum Co. of Canada and the Shawinigan Water Power Co. from Oct. 8, to Dec. 10, 1951. Seeding was conducted on 53 days and resulted in "1¼ inches of precipitable water" over 30,000 sq mi, and about an in. for the 16,000 sq mi of the Shawinigan watershed." Daily amounts ranged from 0 to .14 in. for 30,000 sq mi. Daily weather charts, fronts, soundings, isohyets and relation to seeding points and a full page of discussion on each situation are presented. Oct. and Nov. 1941 (a year with heavy precipitation) is compared with Oct. and Nov. 1951 for evaluation. (*Same item as* 3.10–89 and 6J–118, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Quebec watershed 2. Quebec, Canada.**—*M.R.*

**11M–346** 551.509.617(45)

Jelmoni, Evaristo, **Un nuovo sistema di lotta contro la grandine.** [A new hail control method.] *Il Coltivatore e Giornale Vinicolo Italiano*, Casali Monterrato, n.s., 98(7):285–286, July **1952. DA** 4(16 C72)—Reviews a note of an anonymous engineer in *Agricoltura Trevisana* claiming to have reconstructed in the laboratory the type of dust existing at 4,000 m altitude in temperate zones. The microscopic section of the condensation nuclei is described. The inventor is pretending to be able by means of a launching tower to produce the natural condensation by ascending currents. The inventor estimates that a maximum surface of 400 km² could be served by one tower. In an editorial note G. Dalmasso cautions against excessive optimism in view of the dubious successes of recent hail control experiments. *Subject Headings:* **1. Hail prevention in Italy 2. Italy.**—*O.T.*

**11M–347** 551.509.617(78/79)

*Krick, Irving Parkhurst, **Increasing water resources through weather modification.** *American Water Works Association, N. Y., Journal*, 44(11):996–1020, Nov. **1952.** 15 figs., 3 tables, 15 refs. Abstracted from reprint. **DLC**—The author, who controls almost all commercial cloud seeding operations west of 95°W in the United States, outlines the basic principles of cloud seeding, explains the production of silver iodide nuclei by ground generators and the activity of field operations, and shows a number of cases where rainfall was up to 400% above normal, claiming this as an obvious success of cloud seeding. The cost of the project is less than 1% of the computed benefits. (*Same item as* 5.2–78 and 6J–119, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding 2. Western U. S. 3. Industrial meteorology 4. Western United States.**—*A.A.*

**11M–348** 551.509.617(78/79)

Krick, Irving P. and Smith, T. B., **Some evaluations of sustained cloud-seeding operations.** *American Geophysical Union, Transactions*, 33(1):53 56, Feb. **1952.** 7 figs., 2 tables. Also: Summerset, John and Smith, T. B., **Discussion [of above article]**, *Ibid.*, 34(1):137–140, Feb. **1953.** figs., tables. **DWB**—Evaluation of silver iodide cloud seeding experiments carried out from July to Dec. 1950 in various western sections of the U. S. Comparison of precipitation with unseeded control areas is made by means of correlations. Except for one case, the precipitation in the target area was higher than in the control areas; but the results are within limits of error, except in July 1950 in New Mexico. It is possible that cloud seeding not only increases the total rainfall amount, but also distributes rainfall more uniformly over wide areas. Summerset compares rainfall over target area with unseeded areas immediately to the north and south and finds that "there is absolutely no indication of an effect due to seeding." Smith agrees that cloud seeding is not effective enough to produce the percentage increase which would be necessary to prove an effectiveness by the suggested statistical method, but states that one of Summerset's control areas believed to be unseeded, was actually seeded. (*Same item as* 4.1–71, 5.4–76 and 6J 120, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Western U. S. 2. Cloud seeding evaluation 3. Western U. S.**—*A.A.*

**11M–349** 551.576.11:551.509.616/7

Lafargue, Camille (*Centre Nat. de la Recherche Scientifique, France and Puy-de-Dôme Obs.*), **Les principes actuels de la modification artificielle des nuages.** [Present-day principles of the artificial modification of clouds.] *Société des Sciences Naturelles du Maroc, Comptes Rendus des Séances Mensuelles*, No. 3:69–70, **1952.** Abstracted from reprint. Stamped on t-p: *Puy-de-Dôme. Observatoire, Publications, Série B*, no. 4, **1952. DWB**—Summary of a lecture delivered at a meeting of the Society of Natural Sciences of Morocco on March 7, 1952 at Casablanca. The physical processes of rain formation, artificial stimulation of rain, and dissipation of clouds, are briefly explained. (*Same item as* 6F–185, June 1955, *Met. Abs.*) *Subject Headings:* **1. Artificial cloud modification 2. Cloud physics.**—*G.T.*

**11M–350** 551.585.53

Lockspeiser, Sir Ben (*British Dept. of Sc. and Ind. Res.*), **The strategy of desert science.** *Impact of Science on Society*, Paris, 3(3):181–186, Autumn, **1952. DWB**—An address delivered at the International Council on Desert Research organized by the Research Council at Israel in cooperation with UNESCO on May 14, 1952 at Haifa. The activities of UNESCO in the promotion of arid zone research, the organizational approval needed to undertake arid zone research, the importance of studying the water supply for deserts with particular reference to cloud seeding as illustrated by the work of E. G. Bowen in Australia and the desalting of brackish water are discussed. (*Same item as* 5.6–260, June 1954, *Met. Abs.*) *Subject Headings:* **1. Arid zone research 2. Water supply 3. Artificial precipitation 4. UNESCO.**—*I.L.D*

**11M–351** 551.509.617

Ludlam, Frank Henry (*Imperial College, London*), **The natural and artificial production of showers.** *International Union of Geodesy and Geophysics. Association of Meteorology, 9th, Brussels, Aug.* 1951, *Procès-Verbaux, Mémoires et discussion*, pub. **1953.** p. 142–148. 3 figs. (Its *AIM* no. 9/c.) Also issued as *Uppsala. Universitet. Meteorologiska Institutionen, Meddelande* No. 39 Also his: **Artificial and natural shower formation.** *Weather*, London, 7(7):199–204, July **1952.** 2 figs., photos. **DWB**—Sets out physics of growth of cloud particles exceeding critical diameter of .01 in., growth of ice crystals into hailstones and raindrops, and artificial shower stimulation by dry ice or AgI or by spraying large droplets into cloud base. (*Same item as* 6J–121, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Precipitation formation 2. Cloud seeding with dry ice 3. Cloud seeding with silver iodide 4. Cloud seeding with water.**—*C.E.P.B.*

**11M–352** 551.509.617(791)

MacCready, Paul B., Jr., **Results of cloud seeding in central Arizona, winter 1951.** *American Meteorological Society, Bulletin*, 33(2):48–52, Feb. **1952.** 2 figs., 4 refs. **DWB, DLC**—Cloud seeding operations were conducted during the winter of 1951 over an area of 10,000 sq mi in central Arizona. The normal precipitation in the target and control area for each month was calculated as follows: "the sum of all monthly normals for the U. S. Weather Bureau stations in the area having normals in the published "Climatological Data" is divided into the sum of all monthly precipitation for those stations, and the ratio expressed as a percentage." And the percent of monthly normal precipitation in the control area was assumed to represent the estimate of naturally occurring percent of normal precipitation in the target area. The monthly increases in rainfall in the seeded region were respectively: 15% (Jan.), 31% (Feb.), 41% (March), 54% (April). The increase in precipitation was found to be roughly proportional to the amount of seeding equipment and its timing. A detailed analysis of the statistical basis for evaluating the effect of seeding is presented. (*Same item as* 3.11–90 and 6J–122, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Arizona 2. Arizona.**—*I.L.D.*

**11M–353** 551.509.617:551.577.33(78/79)

Mann, D. H., **Who made it rain?** *Idaho Farmer*, Boise, 70:252, 274–275, 3 Apr. **1952.** 6 figs. **DA**—Irving P. Krick's report on the success of cloud seeding in 14 southern Utah and four Colorado counties, as discussed in the Richfield, Utah meeting March 10, 1951, is presented. Four diagrams show the seasonal precipitation amounts derived from 1891–1944 Weather Bureau charts. It seems, that seeding of clouds to produce ice crystals under ordinary steady rain or warm front conditions is not practical because these clouds already have ice crystals in them, and the seeds released under the warm front generally will not be able to penetrate the inversion and reach the precipitating cloud. *Subject Headings:* **1. Cloud seeding effectiveness 2. Seasonal precipitation variations 3. Western United States.**—*O.T.*

**11M–354** 551.509.617:551.578.71(452)

Maseroli, —, **Un mezzo efficace contro la grandine.** [An effective means of hail control.] *Avvenire Agricolo*, Parma, 60(9):227, Sept. **1952. DA** (16 Av9)—Hail damage amounts to 50 billion lire per year in Italy. Considering that 40% government support for installation is provided, 1000 l per hectar should be sufficient for efficient hail control in the province of Parma. *Subject Headings:* **1. Hail prevention in Italy 2. Parma, Italy.**—*O.T.*

**11M–355** 551.509.617(794)

North American Weather Consultants, Pasadena, Calif., **Increasing rainfall and snowpack through cloud seeding. 1952.** 8 unnumbered pages. 12 figs. **DWB**—An attractively illustrated pamphlet giving a few of the scientific principles of natural and artificial precipitation formation, the functions of the North American Weather Consultants Meteorological Office in Pasadena, and their operations in cloud seeding by silver iodide throughout the Western States. A map shows location of generators and rain gages in Southern California. (*Same item as* 4.2–74, Feb. 1953, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Western U. S. 2. California.**—*M.R.*

**11M–356** 551.509.617(794)

*North American Weather Consultants, Pasadena, Calif., **Report on cloud seeding operations in Santa Barbara County, Nov. 1951–May 1952. Prepared for the County of Santa Barbara.** Their *Report*, 6–6, Aug. **1952.** 19 p. 36 figs., tables, refs. **DWB**—Precipitation during 6 months of cloud seeding operations (over 1000 hrs) was up to 320% above normal and 27% in excess of "natural" precipitation computed by means of an unaffected control area. The percentage of normal monthly and seasonal values of normal storms is shown on maps, meteorological storm analyses are made, and scatter diagrams compare target and control area precipitation. Cloud seeding was made by both ground and airplane generators. (*Same item as* 5.4–74 and 6J–123, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in California 2. Precipitation distribution 3. Santa Barbara County, Calif.**—*A.A.*

**11M–357** 551.509.617

*North American Weather Consultants, Pasadena, Calif., **Report on cloud seeding operations in the southern Cascades, Nov. 1951–April 1952. Prepared for California Oregon Power Company.** Their *Report*, 6–8, Sept. **1952.** 37 p. 18 figs., numerous tables, 18 refs. **DWB**—This report covers the operation and evaluation of results of a cloud seeding program directed toward increasing snow pack in the Southern Cascades during the 1951–52 winter season. In this report appear discussions of: the physical processes of natural and artificially induced precipitation processes (sections 3 and 4); the instrumentation of the cloud seeding program (section 5); a summary of weather events during the program (section 6); and an evaluation of results (sections 7 and 8). It is concluded that during the 1951–52 season, cloud seeding increased snow pack in the target area by 33% above what could be expected on the basis of comparison with an historically related area to the north. Runoff appears to have been raised by about 25%. It is recommended that essentially the same seeding plan be followed for another year. (*Same item as* 5.1–98 and 6J–124, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in California 2. Cascade Mountains.**—*A.A.*

**11M–358** 551.508.822 551.508.824 551.509.61

Reed, Dale, **Rain or shine, science slowly conquers the weather.** *Purdue Engineer*, 47(8):10–11, 26, 32, May **1952.** 6 photos. **DWB**—A popular article on modern methods of observing and forecasting the weather, including the radiosonde, automatic weather stations and cloud seeding to control weather. (*Same item as* 6J–127, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Weather forecasting 2. Weather control.**—*M.R.*

**11M–359** 551.579:551.509.617

§Reichelderfer, Francis W. (*U. S. W. B., Wash., D. C.*), **Physical basis of water supply for the United States.** (In: U. S. Congress. House. Committee on Interior and Insular Affairs, **Physical and Economic Foundation of Natural Resources,** Vol. 2:11–14, **1952.** graphs, charts.) **DWB**—Meteorological aspects which are important for the evaluation of the hydrologic cycle are summarized. The discussion is illustrated by maps (for the U. S.) of annual, winter, summer, Jan. and July precipitation, of minimum and maximum annual precipitation, annual evaporation from free water surfaces and sample maps of single storms. The general circulation is characterized by the normal pressure distribution over the Northern Hemisphere in Jan. A nomogram for the computation of storm runoff from precipitation, considering the season and the duration of the storm, is presented, as well as a nomogram showing the flood routing procedure for the Ohio River. Most of the discussion is devoted to artificially induced precipitation. The physical basis of the precipitation process is explained, the working hypothesis of the "rain increasers" outlined, and a sound scientific approach to the problem presented. (*Same item as* 5.9–257 and 6J–128, *Met. Abs.*) *Subject Headings:* **1. Hydrometeorology 2. Precipitation charts 3. Runoff forecasting 4. Artificial precipitation 5. United States. I. U. S. Congress. House Committee on Interior and Insular Affairs.**—*A.A.*

**11M–360** 551.574.1:551.521

Reynolds, S. E., Hume, William, II and McWhirter, Max (*New Mexico, Inst. of Mining and Technology, Socorro*), **Effects of sunlight and ammonia on the action of silver-iodide particles as sublimation nuclei.** *American Meteorological Society, Bulletin*, 33(1):26–31, Jan. **1952.** 4 figs., 4 refs. **DWB, DLC**—Report on experimental determination of the behavior of silver iodide particles exposed to mineralite ultraviolet radiation and to sunlight, with or without addition of ammonia. It was found that concentration of effective nuclei in AgI will noticeably decrease under exposure to sunlight or ultraviolet radiation. By adding ammonia the AgI nuclei become re-activated. Data obtained during the experiments are presented on graphs. It is pointed out that addition of ammonia before exposure to sunlight will decrease rather than increase the number of effective silver iodide nuclei. An explanation of this phenomenon is offered. (*Same item as* 4.3–193, March 1953,

*Met. Abs.*) *Subject Headings:* **1. Silver iodide decay 2. Sublimation nuclei 3. Sunlight effects on silver iodide 4. Ultraviolet light effects on nuclei.**—*G.T.*

**11M–361** 551.574:551.578.41

Reynolds, S. E., **Ice-crystal growth.** *Journal of Meteorology*, 9(1):36–40, Feb. **1952.** 12 figs., table, 4 refs. **DWB**—Describes a laboratory study of rate of ice crystal growth in supercooled clouds at −20 to −16°C seeded with dry ice. Diagrams show frequency distributions of snowflake diameters after 10–165 sec, relations between thickness and density, and growth of mass with time; they agree well with HOUGHTON'S calculations. It is considered that a convective cloud might be effectively seeded from ground by a very little silver iodide but overseeding is unlikely. (*Same item as* 3.9–181 and 6F 203, *Met. Abs.*) *Subject Headings:* **1. Ice crystal formation 2. Cloud seeding experiments.**—*C.E.P.B.*

**11M–362** 551.509.617(569.4)

Rosenan, Naftali, **A climatological analysis of cloud seeding experiments during the rainfall year 1950–51 in Israel.** Hakirya, Israel, Rainfall Research Committee, Aug. **1952.** Also his: **Climatological analysis of cloud seeding experiments during the second year of the experimental period, 1951/2, in Israel.** *Ibid.*, Dec. **1952.** 6 p. ref., map. **DWB**—During the year 1950–51, 18 attempts were made to seed clouds with AgI smoke generated at the ground at Aeftsibah, Israel. The results were assessed by means of rainfall charts drawn on each of these 18 days, and comparison with random days where no seeding occurred. It appeared that on at least 6 occasions some increases, which did not occur normally, occurred downwind from the generator. Frequency analysis also shows a concentration of anomalous (increase) precipitation on seeding days. However, there is considerable variation in occurrence of precipitation on the 18 days seeding was carried out. During the 1951–52 season 27 seeding experiments were carried out. The tests show some evidence that experiments were successful. (*Same item as* 4.8–70, 5.1–99 and 6J–129, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with silver iodide 2. Cloud seeding in Israel 3. Israel. I. Israel Rainfall Research Committee.**—*M.R., A.A.*

**11M–363** 551.509.617(44)

Ruby, Frederic-Leon, **Étude sur l'action des fusées paragrêles explosives et à iodure d'argent.** [Study of the effect of explosive and silver-iodide hail control rockets.] *L'Agriculture Pratique*, 115(9):419–422, Sept. **1951.** Also his: **Les méthodes actuelles et nouvelles de défense contre la grêle.** [Current and new methods of hail control.] *Agriculture*, Paris, 16(135):133–136, May **1952.** figs. Also his: **Los nuevos métodos de defensa contra el pedrisco.** [New methods in hail control.] *Instituto Agricola Catalan de San Isidro, Barcelona, Revista*, 101(10, 11, 12):237–244, 267–271, 295–299, Oct., Nov., Dec. **1952. DA**—The process of hail formation and the mechanism through which hail control rockets are effective are described. It is estimated that during the 15 years of systematic hail control activities in France more than 50% of the hailstorms have been warded off. According to the second paper rockets dispersing silver iodide were introduced in Nov. 1950 and used twice in 1951. The purpose was to obtain intense rainfall in limited areas (such as 2 by 7 km) which was achieved in each case. Photographs showing hail control equipment are presented. The Catalan version contains generally the same information. (*Same item as* 6J–130, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Hail prevention in France 2. Silver iodide rockets 3. France.**—*G.T.*

**11M–364** 551.509.617(09)

Schaefer, Vincent J. (*Genl. Elec. Co.*), **Progress in control of meteorological factors.** (In: Pennsylvania Electric Association. Hydraulic Power Committee, **Symposium on climatic trends in Northeastern United States, April 22 23, 1952: Minutes. 1952.** p. 107–120. **Discussion.** *Ibid.*, p. 121–123.) **DWB**—Review of 5 years of laboratory and field work in experimental meteorology by SCHAEFER and colleagues at General Electric, especially in the fields of cloud physics, rain making, cloud and fog dispersal, study of nucleation and ice crystal growth, etc. at Mt. Washington, Schenectady and in New Mexico. In the discussion he mentions the weekly periodicities in rainfall which LANGMUIR hypothesized. (*Same item as* 6.3–87 and 6J–131, *Met. Abs.*) *Subject Headings:* **1. Project Cirrus 2. Cloud seeding research 3. Progress in weather control.**—*M.R.*

**11M–365** 551.509.617:34

Schaefer, Vincent J., **Should rainmaking be controlled?** *Kansas. State Board of Agriculture, Report*, 71(308):34–41, June **1952,** fig. **DA** (2 K13Re)—Possibilities of weather modification are considered. The difference between condensation nuclei and ice nuclei and the process of supercooling by ice crystals are explained. The five-year research studies at Schenectady supported by the Army Signal Corps and the Office of Naval Research resulted in the need for more laboratory studies. The problems of organizing control, legal regulation and evaluation of cloud seeding activities are discussed. *Subject Heading:* **1. Weather control legislation.**—*O.T.*

**11M–366** 551.509.617:551.509.31(94)

*Smith, E. J. (*Univ. Grounds, Sydney*), **The influence of meteorological conditions on rainmaking in the Sydney area.** *Australian Journal of Scientific Research, Ser. A, Physical Sciences*, Melbourne, 5(1):87–103, March **1952.** 9 figs., 5 tables. **DLC**—Between Jan. 1948 and June 30, 1950, 88 flights were made within 150 miles of Sydney, Australia, to stimulate rainfall by artificial means. These flights are tabulated and classified according to synoptic situation, height of freezing level above or below normal, water content of cloud 2000 ft > freezing level, difference in height between 0 and 10°C isotherms. These criteria are correlated individually with relative success of attempts (whether rain was induced, reached the ground or not), and the most important criteria thus determined. High water content 2000 ft above freezing level was a good criteria for success, but even better was a "rainmaking index" made up from synthesis of various parameters. For 1948, 1949 and 1950 the number of possible days for rainmaking was 45, 33 and 8. Synoptic situations favorable for rainmaking are illustrated. Forecasts from synoptic charts alone are better indication than when yesterday's radiosonde data are used. Improvements might occur if today's ascent were available just prior to the flight. (*Same item as* 4.2 76 and 6J–132, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Australia 2. Cloud seeding evaluation 3. Sydney, Australia.**—*M.R.*

**11M–367** 551.509.617(529)

*Taihoku, Formosa. Rain Stimulation Research Institute, **Condensed report on experiments of rain making over Sun-Moon Lake.** Taipei, Taiwan, May **1952.** 4 p. table (fold.). Mimeo. **DLC**—The Rain Stimulation Research Institute was organized in May 1951 under auspices of the Taiwan Power Co., Chinese Petroleum Corp. and Central Weather Bureau and a research laboratory set up at Chia Yee Solvent Works. A ground generator for AgI seeding was ready at the time of the report to be tested in the Sun-Moon Lake area. A locomotive was also used as a AgI smoke generator, with 5 tests at Chia Yee (results said to be favorable), about 40 tests made with both dry ice and AgI during 22 airplane flights from 10,500 to 16,500 ft from Jan. 22, 1951 to April 1, 1952 are discussed and results tabulated. Report claims results are quite satisfactory, but for tropical (warm) clouds AgI has little effect though saturated NaCl used in 2 flights gave satisfactory results. (*Same item as* 6J–133, Oct. 1955, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding in Formosa 2. Formosa.**—*M.R.*

**11M–368** 551.509.617

Thom, Herbert C. S. (*U. S. W. B., Wash., D. C.*), **The evaluation of cloud seeding operations.** Paper presented at CBIAC Meeting at Portland, Oregon, Feb. 20, **1952.** 6 p. 2 figs. Typescript. **DWB**—The methodological difficulties encountered in obtaining sensitive evaluation of attempts to increase precipitation by cloud seeding are discussed in nontechnical language. The target-control area experiment involves a procedure in which the effect of seeding is compared with concurrent records over an area expected to have related amounts of precipitation. The normal precipitation to be expected on the target in relation to that received on the control depends upon the amount received on the control. The target-control area technique of evaluation is illustrated by means of a diagram and discussed in detail. (*Same item as* 4.8–71 and 6J–134, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding evaluation.**—*I.L.D.*

**11M–369** 551.509.617(675)

Troch, P. (*Mining Corp., Upper-Katanga*), **Provocation artificielle de pluie au Katanga.** [Artificial stimulation of rain at Katanga.] (In: Congres Scientifique, Elizabethville, Belgian Congo, Aug. 1950, **Comptes Rendus, vol. 2, Travaux de la Commission Géographique et Géologique,** pub. Brussels, [**1950?**] p. 250–268. 3 figs., 5 refs.) **DLC.** Also in: *Courrier Agricole*, Leopoldville, 17(11):1–4, May 28, **1952.** 5 refs. **DA.** Summary in French in *Puy-de-Dôme. Observatoire, Bulletin*, [Ser. 2], No. 1:21–22, Jan./March **1954. DWB**—Cloud seeding experiments were conducted over the Lufira Basin, Katanga, in April 1950. Dry ice bombs were released at the top of developed cumuliform clouds and exploded approximately 300 m below. Two of the five flights were unsuccessful owing to adverse meteorological conditions. The other flights gave satisfactory results, especially the last one in which extensive precipitation was obtained from a high cumulus cloud. The author believes that the cloud top would have developed into a false cirrus, had it not been for the seeding operation. Laboratory experiments are mentioned in which aerosols were produced from germanium chloride. (*Same item as* 6J–81, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Belgian Congo 2. Cloud seeding evaluation 3. Katanga, Belgian Congo.**—*G.T.*

**11M–370** 551.574.1

Turnbull, David and Vonnegut, Bernard (*General Electric Research Lab., Schenectady*), **Nucleation catalysis.** *Industrial and Engineering Chemistry*, 44(6):1292–1298, June **1952.** 6 figs., 4 tables, 24 eqs., 32 refs. **DLC**—It is known that the structures of crystals and the substances that catalyze their formation closely resemble each other in atomic arrangement and lattice spacing on certain

low index planes. A crystallographic theory of crystal nucleation catalysis predicts that the order of catalytic potency should be identical with the order of the reciprocal of the disregistry ($1/\delta$) between the catalyst and forming crystal on low index planes of similar atomic arrangement; that for small $\delta$ nuclei should form coherently with the catalyst—i.e., with a strain $\epsilon=\delta$; and that for $\delta$ very large $\delta \gg \epsilon$ and the interface between nucleus and catalyst can be thought of as consisting of regions of good fit separated by a dislocation gridwork. The energy of this interface should be proportional to the dislocation density, hence to $\delta-\epsilon$. There is evidence that ice nuclei may form coherently on silver iodide surfaces ($\delta=0.0145$). Experience indicates that in general nuclei form coherently with catalysts only for $\delta \lesssim 0.005$ to 0.015. (*Same item as* 4.7–146, July 1953, *Met. Abs.*) *Subject Headings:* **1. Nucleation 2. Ice crystal formation 3. Silver iodide nucleation.**—*Authors' abstract.*

**11M–371** 551.509.617(78/79)

U. S. Dept. of the Interior. Committee for the Evaluation of Bonneville Power Administration Cloud-Seeding Operations in the United States Portion of the Pend Oreille River Basin, **Report.** Pub. by the Dept., July **1952.** 94 p. 28 figs., 4 illus., maps, graphs, 15 refs. **DWB**—Statistical material related to the cloud seeding activities in western Montana, northern Idaho and the northeastern corner of Washington is presented and analyzed. In these experiments six AgI generators were operated from Sept. 21 to Sept. 30, 1951 for a total of 286 generator hours. The statistical study is based on precipitation and runoff data for the operation period which are compared with long period mean values. Probabilities of occurrence and significance of the results obtained are determined. Although some positive effect could be observed, the Committee states that more extensive material would be necessary in order to reach final conclusions. A paper by VINCENT J. SCHAEFER on **The use of silver iodide particles for seeding supercooled clouds** is incorporated into the report. (*Same item as* 5.1 101 and 6J 135, *Met. Abs.*) *Subject Headings:* **1. Statistical techniques 2. Cloud seeding with silver iodide 3. Cloud seeding in Northwestern U. S. 4. Northwestern United States. I. Schaefer, V. J.**—*G.T.*

**11M–372** 551.509.617

†U. S. Weather Bureau, **Cloud seeding methods.** Washington, D. C., Feb. **1952.** 8 p. 21 refs. **DWB**—Methods of seeding by dry ice, AgI and water drops (clouds above freezing) and techniques now in use to initiate precipitation more effectively are outlined. Design and evaluation of experiments depend on type and thickness of clouds, wind conditions and temperature of cloud base and top. Number of recent articles (1949–52) on cloud seeding are in the appended bibliography. (*Same item as* 4.9–61 and 6J 136, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding techniques.**—*M.R.*

**11M–373** 551.509.617(797)

U. S. Weather Bureau, **Tentative plans for Weather Bureau artificial cloud nucleation (ACN) project.** Wash., D. C., Nov. **1952.** 18 p. diagr. Mimeo. **DWB**—An elaborate plan for testing the effectiveness of cloud seeding by dry ice and silver iodide in the southwestern part of Washington State and northwestern Oregon is described. The Weather Bureau expects to conduct these experiments with the help of the Navy, Signal Corps, NACA, CAA and the Air Navigation Development Board. Cloud drop spectra, temperature, liquid water content and ice crystal content of clouds and other data necessary to a study of the physics of rain formation will be obtained from the air. A fixed network of rain gage stations will be used for each trial, and control days and control areas will be set aside for statistical evaluation. (*Same item as* 5.4–77 and 6J–137, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Northwestern United States 2. Cloud seeding evaluation 3. Western Washington 4. Northwestern United States.**—*M.R.*

**11M–374** 551.509.617

U. S. Weather Bureau. Scientific Services Div., **Evaluation of Dr. Langmuir's claims of producing weekly cycles in weather by cloud seeding.** June 6, **1952.** 3 p. 2 refs. Mimeo. **DWB**—A brief official statement of the U. S. Weather Bureau. Langmuir's claims were examined in detail with negative results. (*Same item as* 4.4 84 and 6J–138, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding evaluation 2. Cloud seeding periodicities 3. Cloud seeding effects.**—*A.A.*

**11M–375** 551.509.617

Veranneman, Norbert L., **Artificial release of precipitation, Pt. 1.** *World Meteorological Organization, WMO Bulletin,* 1(2):44–45, July **1952. Pt. 2.** *Ibid.,* 1(3):64–76, Oct. **1952. DWB.** Also: Translation into Spanish as: **Precipitación artificial,** in *Revista Meteorológica del Peru,* Lima, 1(1):32–36, Dec. **1954. DWB**—Review of progress in cloud physics and artificial precipitation. Topics covered are stability of clouds, natural rain formation processes, supercooling, ice crystals, efficiency of sublimation nuclei, choice of cloud to seed and verification of results. (*Same item as* 6J–139, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud physics 2. Artificial precipitation.**—*M.R.*

**11M–376** 551.509.617

Vonnegut, Bernard (*Genl. Elec. Co.*), **Cloud seeding.** *Scientific American*, 186(1):17–22, Jan. **1952.** 6 figs. **DLC, DWB**—The author sums up the theory and problems of cloud and precipitation formation and cloud seeding and gives a survey of the history and results of Project Cirrus. A cloud chamber photograph, two excellent cloud photographs taken after seeding, an electron microphotograph of particles in silver iodide smoke and a picture of airplane and equipment are presented and a study of ice crystal persistence due to dry ice and AgI shown in a graph. (*Same item as* 3.5–105 and 6J–140, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding research 2. Project Cirrus.**—*G.T.*

**11M–377** 551.574.2:551.509.617

Vonnegut, Bernard and Maynard, Kiah (*Genl. Elec. Res. Lab., Schenectady, N. Y.*), **Spray-nozzle type silver-iodide smoke generator for airplane use.** *American Meteorological Society, Bulletin*, 33(10):420–428, Dec. **9952.** 13 figs. **DWB, DLC**—A detailed description of air-borne spray nozzle type silver iodide generator with the aid of schematic diagrams and photographs is presented. It is so designed as to make the apparatus safe and to shield the flame from the air stream. This generator is based upon an atomizing type of spray nozzle. A solution of AgI in acetone and sodium iodide is atomized in the nozzle by means of a compressed inflammable gas such as hydrogen. The spray and gas are ignited and burn as a hot flame on issuing from nozzle; the AgI is vaporized and then condensed as very fine particles. The installation of this generator and its application in seeding of cumulus clouds are described. (*Same item as* 4.8–63 and 6J–141, *Met. Abs.*) *Subject Heading:* **1. Silver iodide smoke generators.**—*I.L.D.*

**11M–378** 551.509.617:633.1(795)

Water Resources Development Corporation, Denver, Colo., **Analysis of cloud seeding operations for Tri-County Weather Research, Inc. Sept. 1950 through June 1951: Final Report.** Its *Report*, No. 103, **1952.** 31 p. figs., 5 tables. **DLC**—The contents of this report include: 1) a summary of the Weather Bureau's Crop Bulletin for Sept. 1950–July 30, 1951; 2) a description of the preparation for and conduction of a cloud seeding operation; 3) location of the AgI generators operated for the benefit of the Tri-Counties Association (Oregon and Washington); 4) a statistical study by means of regression equations of the relationship between winter wheat yields in Morrow, Sherman and Gelliam Counties, Oregon and rainfall; 5) a summary of the precipitation data for the Tri-County Area for the period March 1950–June 1951; and 6) a simple account of the technique of evaluating the effectiveness of cloud seeding. (*Same item as* 4.10–86 and 6J–142, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding techniques 2. Cloud seeding in Oregon 3. Wheat yield 4. Oregon.**—*I.L.D.*

**11M–379** 551.509.617

*§Weather Modification Company, Redlands, Calif., **Cloud seeding experiments in Santa Clara County, Dec. 1, 1951 through March 31, 1952.** 59 p. 27 figs., tables. **DWB**—Detailed report on cloud seeding operations by means of ground generators. Rainfall data for target and control areas are presented. Statistical tests show 10% increase over naturally expected rain, computed by means of regression formulas. Synoptic analysis given for each storm, based on synoptic charts, tropospheric wind charts and ascent data. (*Same item as* 4.10–87 and 6J–143, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in California 2. Santa Clara County, Calif. I. Battle, John A. II. Jones, W. Floyd III. Todd, Clement.**—*A.A.*

**11M–380** 551.509.617

*Weather Modification Company, Redlands, Calif., **Report of cloud seeding experiments for the Grand River Valley Weather Improvement Association, Lemmon, South Dakota, May 15 July 31, 1952.** 21 p. tables, diagrs. **DWB**—A serious attempt to test the effectiveness of cloud seeding. From ten years of rainfall observations a regression equation was developed to compute the "natural" rainfall in the seeded target area from rainfall measurements in three control areas. The actual rainfall was 23% higher. Probability of chance 1:5. Over seven seasons would be necessary to raise significance to 1:100. The report gives detailed actual data and computations and shows the operation of silver iodide ground generators according to weather conditions. (*Same item as* 4.10–88 and 6J–144, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in South Dakota 2. Grand River Valley, So. Dakota I. Battle, John A. II. Jones, W. Floyd III. Todd, Clement.**—*A.A.*

**11M–381** 551.509.617

Weickmann, Helmut K., **Das Problem der künstlichen Vermehrung von Aufgleitniederschlägen.** [The problem of artificially increasing upglide rainfall.] *Germany. Deutscher Wetterdienst in der U. S.-Zone, Berichte*, No. 38:401–407, **1952.** 4 figs., 4 tables, 21 refs. German and English summaries p. 401. **DWB**—The precipitation due to a warm front upglide is analyzed. The possible effect of increasing the number of nuclei is discussed, but it is found that the rainfall intensity depends mainly on convergence. Nuclei are of secondary importance and can only increase precipitation

locally when the upglide is irregular. (*Same item as* 4.2–77 and 6J–145, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation.**—*C.E.P.B.*

**11M-382** 551.509.617

Wendt, Gerald. **Coaxing rain out of the clouds.** *United Nations. Educational, Scientific and Cultural Organization, Courier*, 5(7):10, July **1952.** illus. **DWB**—The forces contributing to the formation of precipitation, such as heat of evaporation, large-scale circulation, and cooling of large air masses, are described and found to be beyond present means of human control. The author, accordingly, believes that "the problems of getting water to the extremely arid deserts are not likely to be solved by rainmaking." The amount of vaporization heat for the volume of water required for a rain one inch deep over a square mile, is estimated as equivalent to that obtained by firing 6400 tons of coal. (*Same item as* 4.4–85, April 1953, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Heat of vaporization.**—*G.T.*

**11M-383** 551.509.617

**Can we make it rain?** *Farm Quarterly*, Cincinnati, 7(2):34–37, 127–131, Summer **1952.** photos. **DWB**—The controversial topic of rain making is discussed in a popular manner. Experiments made with dry ice and AgI at General Electric Res. Lab., Schenectady, N. Y. and various commercial cloud seeding enterprises in the West, in California, in Massachusetts, New York, Cuba and Peru are described. Photographs of falling water droplets, of a laboratory cloud, of a "race track" seeding pattern, of silver iodide generators in action, of members of Project Cirrus and of Dr. F. W. Reichelderfer from U. S. Weather Bureau are presented. Several statements made by authorities in the field are quoted. The author concludes that although it is not yet possible to produce rain exactly at the desired place and time, "there seems to be fairly complete agreement among all the people in the weather field that given the right conditions rainfall can be increased" and the absolute control of precipitation may well become a reality within a not too distant future. (*Same item as* 4.2–68, Feb. 1953, *Met. Abs.*) *Subject Heading:* **1. Artificial precipitation.**—*G.T.*

**11M-384** 551.509.617

**Eine neue Methode zur künstlichen Erzeugung von Niederschlag aus Cumuluswolken.** [A new method of artificially causing rain from cumulus clouds.] *Annalen der Meteorologie*, 5(1–2): 45–46, **1952.** **DWB**—Account of Bowen's method of spraying clouds with water. (*Same item as* 4.2–70, Feb. 1953, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding with water.**—*C.E.P.B.*

**11M-385** 551.509.615

**FIDO, FIDO burning bright.** *Aeroplane*, London, 83(2157):696–697, 699, Nov. 21, **1952.** 4 figs. **DLC**—A brief but informative account of the history of FIDO (Fog Investigation Dispersal Operation) in connection with the last demonstration (Nov. 11, 1952) which was staged at Blackbushe, Eng. FIDO was conceived in 1921 by Sir Napier Shaw and Prof. Lindemann (Lord Cherwell), but no experiments were undertaken until 1936. In 1942 Churchill ordered development work to be speeded up, and by 1943 several successful landings had been made by FIDO. In all, 2524 landings and 182 take-offs were made during the war, with a consumption of 37 million gallons of fuel. Six airports were equipped for FIDO but after the war only 3 were maintained, and from 1948–1952 only one landing was made by FIDO. During this year's test, 4 airliners took off and landed to test passenger reaction, plane performance, turbulence, visibility, heat and smoke drift. (*Same item as* 4.11–82 and 6J 108, *Met. Abs.*) *Subject Headings:* **1. Artificial fog dissipation 2. Airport landing aids 3. Fog Investigation Dispersal Operation, FIDO 4. England.**—*M.R.*

**11M-386** 551.509.617:551.576.1(09)

**"Project Cirrus"—the story of cloud seeding.** *General Electric Review*, 55(6):8–26, Nov. **1952.** **DWB**—A complete history of the famous experiments of Schaefer and Langmuir in producing ice nuclei in a deep freeze by means of dry ice pellets or other cooling devices, or by means of silver iodide smoke, and in producing modification in natural supercooled clouds by similar means. The discovery was an outgrowth of contractual work by the General Electric scientists, beginning in 1940, on precipitation status, aircraft icing and artificial smoke screens. The "cold box" experiment was made by Schaefer in 1946 and the first snow storm was produced Nov. 13, 1946. Project "Cirrus" began Aug. 25, 1947, although preliminary work had been done under contract with the U. S. Signal Corps, ONR and Air Force beginning Feb. 28, 1947. Results of operations in Central America, Hawaii, Puerto Rico, New Mexico and other places are outlined, and incidental physical and instrumental work described. Discovery of "periodicities" induced by periodic AgI seeding, hurricane and forest fire modification experiments, study of statistical significance of cloud seeding trials in New Mexico, modification of supercooled ground fogs, orographic thunderstorms, towering cumulus, etc., hail prevention legislation regarding rain making and other limitations to artificial rainfall operations are described. Many fine illustrations of cloud modification, instrumentation in the

laboratory and on aircraft, etc. are included. (*Same item as* 4.9–58 and 6J–125, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding research 2. Project Cirrus 3. Progress in weather control. I. Langmuir, Irving II. Schaefer, Vincent J. III. Vonnegut, Bernard.**—*M.R.*

**11M–387** 551.509.617(67)

**Rain making with common salt.** *Current Science*, Bangalore, 21(10):295, Oct. **1952. DWB**—Brief account of report by D. A. DAVIES of trials in East Africa (Nairobi) by Overseas Food Corporation using a mixture of 90% sea salt and 10% $CaCl_2$ ground to 0.5$\mu$ particle size. The salt is taken aloft in balloons which burst at base of Cu clouds (gunpowder with time fuse used for release). AgI is only effective in clouds below freezing. Hygroscopic particles may be effective above freezing and, hence, useful in seeding nonfreezing clouds in the tropics. (*Same item as* 4.9–60 and 6J 126, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with salt 2. Rain from nonfreezing clouds 3. East Africa. I. Davies, D. A.**—*M.R.*

**11M–388** 551.509.616:551.578.7:551.507.362.1

**Die Steighöhe der Hagelabwehr-Raketen.** [Height of ascent of hail control rockets.] *Die Grüne*, Zurich, 80(19):526–530, May 9, 1952. 5 figs., 2 tables. **DA**—Hail protection by means of rockets has been used in the past four years on the Magadino Plain and elsewhere in northern Switzerland. Trigonometric measurements by a telemetric detachment of the Swiss Army were conducted at Cugnasco on Sept. 15, 1951, a clear calm day, perfect for visible ascent recordings. The 64 rockets fired were from four different manufacturers and included 9 different types with a variety of explosive charges and firing mechanisms. The adequacy of the rockets could not be determined because they did not reach their targets. Minimum elevation reached was 800 m, maximum 1200–1300 m. A graph features the peculiar tendency of S.S.E. displacement of the point of detonation. The tables, feature details pertinent to the rockets. (*Same item as* 10.10–187, Oct. 1959, *Met. Abs.*) *Subject Heading:* **1. Hail rockets.**—*W.N.*

## 1953

**11M–389** 551.577:06

Ackermann, W. C. (*Tenn. Valley Authority, Knoxville*), Albertson, M. L. and Berger, G. L., **Report of the Research Committee on Precipitation, 1951–1952.** *American Geophysical Union, Transactions*, 34(1):133, Feb. **1953. DWB**—Short general report on research activities on snow interception, forest influences, water balance, artificial nucleation, etc. Processing and publication of hourly precipitation data of the special hydroclimatic network, established in 1937, stopped in the past year (2300 recording and 600 nonrecording rain gages). (*Same item as* 6.1–260, Jan. 1955, *Met. Abs.*) *Subject Headings:* **1. Precipitation studies 2. Hydroclimatic networks. I. A.G.U. Research Committee on Precipitation.**—*A.A.*

**11M–390** 551.509.6:06.045(73)

**Advisory Committee on Weather Control.** *Weatherwise*, 7(1):11–22, Feb. **1954.** photo. **DWB, DLC.** Also: **Congress seeks advice on rain-making legislation.** *Science News Letter*, Wash., D. C., 64(8):125, Aug. 22, **1953. DWB**—The first article lists the membership of the Committee on Weather Control appointed by PRES. EISENHOWER under Public Law 256, 83rd Congress, Aug. 13, 1953. Civilian members (K. C. SPENGLER, J. J. GEORGE, LEWIS W. DOUGLAS, A. M. EBERLE and HOWARD T. ORVILLE, Chairman) are shown in a photograph. Aims of the Committee are outlined. The second article is a short note on the establishment of the Committee. A final report is to be submitted by 1956. (*Same item as* 6.6–127, June 1955, *Met. Abs.*) *Subject Headings:* **1. U. S. Advisory Committee on Weather Control 2. United States. I. Orville, Howard T.**—*M.R., A.A.*

**11M–391** 551.509.617

†Albani, Felix (*Argentine Nat. Met. Serv.*), **La modificación artificial de la precipitación.** [Artificial modification of precipitation.] *Meteoros*, Buenos Aires, 3(2/3):247–275, April/Sept. **1953.** 82 refs. English summary p. 247. **DWB**—A comprehensive and critical review of the theoretical basis underlying the attempts to increase precipitation by cloud seeding and a description of the various attempts (both commercial and governmental) of cloud seeding made in different parts of the world to increase rainfall by different methods of cloud seeding. The author concludes that precipitation can be increased artificially under special climatic conditions as demonstrated by Canadian and Australian experiments. (*Same item as* 5.9–90 and 6J–146, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding.**—*I.L.D.*

**11M–392** 551.593.63:551.509.617

Alby, E., **Phénomènes optiques apparaissant dans les stratus surfondus traités par l'iodure d'argent.** [Optical phenomena in supercooled stratus seeded with silver iodide.] *Puy-de-Dôme*,

*Observatorie, Bulletin*, Ser. 2, No. 2:51-54, April **1953.** 2 figs., table, 6 refs. **DWB**—The optical phenomena discussed are as follows: halo of 22°, halo of 46°, parhelia and circumzenithal arc tangent with halo of 22° and solar columns. (*Same item as* 6J-147, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Halo observation 2. Cloud seeding with silver iodide.**—*I.L.D.*

**11M-393** **551.509.617**

American Meteorological Society, **Statement of weather modification.** Its *Bulletin*, 34(5): 218-219, May **1953. DWB**—Seeding of supercooled clouds with dry ice and injection of small water drops or salt particles in the bases of warm cumulus clouds can initiate certain modifications with the cloud and sometimes trigger the release of precipitation. Poorer results are obtained with AgI. Statistical analyses have not shown a significant increase of precipitation by ground-based silver iodide seeding. Large scale weather modification by cloud seeding is not proved. (*Same item as* 5.1-92 and 6J-148, *Met. Abs.*) (For later statement *see* 11M-760.) *Subject Headings:* **1. Weather control 2. Cloud seeding.**—*A.A.*

**11M-394** **551.509.616**

aufm Kampe, H. J.; Weickmann, H. K. and Kelly, J. J., **Seeding experiments in supercooled stratus clouds.** *U. S. Signal Corps Engineering Laboratories, Ft. Monmouth, N. J., Technical Memorandum*, No. 1576, Dec. 7, **1953.** 23 p. 80 figs., photos, diagrs. **DWB**—The procedure and experimental results of a series of experiments in which supercooled stratus clouds were seeded from aircraft with dry ice and silver iodide are presented. It was found that seeding with dry ice modified a supercooled cloud layer to such an extent that ground becomes visible through parts of it, that overseeding is not as common as is generally assumed that, on the average, ground can be seen within one half hour after seeding and that on the average a seeded line spreads within about one half hour. Synoptic charts and photographs of stratus clouds before and after seeding are presented. (*Same item as* 6J-149, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with silver iodide 2. Cloud seeding with dry ice.**—*I.L.D.*

**11M-395** **551.509.617(795)**

Beaumont, R. T. (*Oregon Agri. Exp. Station, Medford*), **Cloud-seeding analysis in Oregon.** *American Meteorological Society, Bulletin*, 34(7):298-303, Sept. **1953.** 12 figs., 5 tables, 5 refs. **DLC, DWB**—Attempts by commercial cloud seeding operators to increase precipitation in the form of snow in the Southern Oregon Cascades during the winter months and precipitation in the Tri-Counties area of Oregon for a ten month period are evaluated by the method of comparing a target and control area. A statistical analysis of the data involving the use of regression curves between control and target areas failed to show a material increase of precipitation in the target areas through cloud seeding. The decrease in the total accumulative snowfall for two counties in the Southern Oregon Cascades is cited as the strongest evidence found in these analyses of a possible modification of precipitation that could be about cases attributed to cloud seeding. (*Same item as* 5.9-91 and 6J-148, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Oregon 2. Oregon.**—*I.L.D.*

**11M-396** **551.509.617:551.578.7**

Bidault, G. (*Casablanca*), **Insémination des nuages à l'aide de mêches génératrices de fumées d'iodure d'argent.** [Cloud seeding by means of wicks producing silver iodide smoke.] *Puy-de-Dôme, Observatoire, Bulletin*, Ser. 2, No. 4:91-96, Oct. **1953.** fig. Also issued as: *Rabat, Morocco. Institut Scientifique Chérifien. Service de Physique du Globe et de Météorologie, Recueil des Publications*, No. 8, **1953. DWB**—A new cloud seeding technique is described in detail. Cotton wicks of the commercial type used for petroleum lamps are filled with charcoal slices impregnated with AgI solution. The device is ignited and sent aloft by means of a balloon. As the cotton is slowly consumed the burning pieces of charcoal are dropped off one by one at approximate intervals of 200 m. Tests conducted with the device in the laboratory and under natural conditions (up to an altitude of 2000 m) are reported. It is believed that this technique will be particularly effective when applied to hail suppression on a local scale. (*Same item as* 6J-151, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with silver iodide 2. Cloud seeding techniques 3. Hail prevention.**—*G.T.*

**11M-397** **551.509.617(64)**

Bidault, G., **La pluie provoquée au Maroc.** [Artificial rainfall in Morocco.] *Rabat, Morocco. Institut Scientifique Chérifien. Service de Physique du Globe et de Météorologie, Recueil des Publications*, No. 7, **1953. DWB.** Reprint from: *Société des Sciences Naturelles et Physiques du Maroc, Comptes Rendus*, No. 8:133-135, **1953.**—A brief review of the theories of rain formation of BERGERON, FINDEISEN, LANGMUIR, BOWEN and SCHAEFER. The results of the seeding of clouds with $CO_2$ and AgI are discussed; they indicate that seeding carried out in eastern Morocco (Oued-el-Abid Basin) produced a considerable increase in rainfall over the normal. (*Same item as* 6J-152, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in French Morocco 2. French Morocco.**—*I.L.D.*

**11M-398** 551.509.617

Bollay, Ronald (*North American Weather Consultants, Pasadena, Calif.*). **Clouds with a silver lining.** *Electrical West*, San Francisco, 110(3):73–76, March **1953.** figs. **DLC**—In connection with AgI cloud seeding operations of western U. S. power companies, the author discusses general principles of rainfall modification, operational details and effective range of AgI generators, evaluation problems and the legal and economic aspects of cloud seeding. Charts and graphs computed by North American Weather Consultants are presented in evidence of successful seeding operations. (*Same item as* 6J-153, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding 2. Silver iodide smoke generators.**—*G.T.*

**11M-399** 551.509.617

Bonacina, L. C. W., **Rain making and its wider implications.** *Weather*, 8(7):216–217, July **1953.** **DWB**—Discussion of the possible repercussions of rain-making on the general distribution of natural rainfall over the globe. (*Same item as* 4.11-84 and 6J-154, *Met. Abs.*) *Subject Heading:* **1. Weather control.**—*C.E.P.B.*

**11M-400** 551.509.617(046)

Bowen, David, **Weather control has become a science.** *Daily Telegraph*, London, No. 301 444:6, Jan. 31, **1953.** Popular article on methods of rain-making by cloud seeding and commerica, possibilities. National and international control are needed. (*Same item as* 4.8 66, Aug. 1953, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation.**—*C.E.P.B.*

**11M-401** 551.577.2:551.510.42:551.590.25(94)

Bowen, E. G., **The influence of meteoritic dust on rainfall.** *Australian Journal of Physics*, Melbourne, 6(4):490–497, Dec. **1953.** 5 figs., 2 tables, 6 refs. Also: **Comments by** W. C. Swinbank. *Ibid.*, 7(2):354–358, June **1954.** 3 refs. And **Comments by** D. F. Martyn. *Ibid.*, 7(2):358–364, June **1954.** fig., table, 8 refs. **DLC.** Neumann, J., **Fluctuations of long-period accumulations of daily rainfall amounts.** *Ibid.*, 7(3):522–526, Sept. **1954.** fig., 2 tables, 3 refs. **DLC**—An examination of daily average rainfall for Sydney, Australia for (a) 1859–1901 and (b) for 1902–1944, and comparable data from British Isles and elsewhere, leads E. G. Bowen to advance the hypothesis that the source of anomalous rainfall peaks on or about the 12–13, 23 and 31st of Jan. is extra-terrestrial, since the effect is worldwide. The fact that these peaks occur about 29 days after the meteor showers of Dec. 13–14, 22 and Jan. 3 leads him to believe that these showers of meteoric dust are responsible. About 10,000 tons of meteoric dust in the $<4\mu$ size ranges fall on the earth each day and the velocity of settling is $<1$ cm/sec below 100 km height, thus taking 30–50 days to settle to the 40,000 or 50,000 ft level where they could seed large Cu clouds. The high concentration of dust at the 100,000 ft level due to rapid deceleration of fall velocity seems to be highly correlated with occurrence of noctilucent clouds. The other three articles discuss some points of Bowen's hypothesis. 1) In his "Comments . . . ," W. C. Swinbank questions the Bowen hypothesis on the ground that meteoric dust coming on a certain date each year should influence frequency rather than intensity of rainfall and this has not been demonstrated by Bowen. Also evidence from the Krakatoa eruption was that dust of size comparable to Bowen's meteoric dust persisted for weeks and caused no unusual disturbance of rainfall regime. In 2) D. F. Martyn remarks that a "peak" normal rainfall for any given day can be found by searching for any excessive amount. If this excessive value is removed, the rainfall for that day may even be deficient below normal, as is the case with some of Bowen's peaks which he ascribed to a regular fall of meteor dust on a given day. Other examples Bowen cites may be due to natural weather singularities, some of which are cited for the British Isles. 3) J. Neumann considers shortcomings in Bowen's hypothesis such as assigning major rainfall peaks to purely physical factors (falling of meteoric dust) and also lack of explanation concerning rain "troughs" or low rainfall amount totals. Instead he proposes "the hypothesis of random accumulations," which accounts for both major rainfall peaks and troughs, and "random fluctuation" as a reason for their periodicity. (*Same item as* 6I-69 and 6J-155, *Met. Abs*). *Subject Headings:* **1. Meteoric dust effect on rainfall 2. Bowen theory 3. Rainfall singularities 4. Noctilucent clouds 5. Sydney, Australia.**—*M.R.*

**11M-402** 551.509.617(75)

*Buell, C. Eugene, **An evaluation of the results of cloud seeding in western New Mexico and southeastern Arizona during July and August, 1951 and 1952.** New Mexico. Univ. Contract Cwb-8161 and Contract Cwb-8305, Terminal Report, June **1953.** 72 p. 24 tables, 5 figs., 3 refs., eqs. Shorter version in: *American Meteorological Society, Bulletin*, 36(1):6–15, Jan. **1955.** fig., 8 tables, eqs. **DWB**—A new evaluation technique was developed since the usual method, comparing target with control area, was not applicable in this case due to extensive commercial seeding by Krick and others. The rainfall index $\log\left(\frac{1000}{N}\sum_{i=1}^{N}\frac{r_i}{R_i}+1\right)$ ($N$ = number of stations, $r_i$ = station

rainfall for the day, $R_i$ = average for the month) was linearly correlated to the mixing ratio at 700 and 500 mb and the temperature difference between these levels. For this difference a negative correlation was found (contrary to common opinion), which was also verified for conditions in Florida. The result of the elaborate analysis: rainfall on seeding days might be a little increased (significance level 9%) but the effectiveness of the whole cloud seeding operation is probably nearly zero. (*Same item as* 6J-156, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Southeastern U. S. 2. Cloud seeding evaluation.**—*A.A.*

**11M-403** 551.574.1:551.509.617(78/79)

Byers, Horace R. (*Chicago Univ.*), **Rational approach to rain making.** *Indian Academy of Sciences, Bangalore, Proceedings, Sec. A*, 37(2):237-247, **1953.** 3 figs., table, refs. p. 246-247. **DLC**—A review of the latest scientific experiments in artificial rain making and a survey of the principles of cloud physics involved. The two prevailing theories of precipitation formation in clouds; the BERGERON theory of ice crystal nucleation in supercooled portions of a cloud and the theory based on nucleation by oversize raindrops which can account for rain from nonfreezing clouds are especially emphasized. Tests to be conducted by the U. S. Weather Bureau in southwestern Washington State (and adjacent Oregon) with homogeneous rainfall patterns, and possible tests with nonhomogeneous (convective) type rainfall are outlined critically. (*Same item as* 5.3-243 and 6J-157, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Cloud physics 3. Cloud seeding in Northwestern United States.**—*M.R.*

**11M-404** 551.509.617(44)

Dessens, H., **Action de l'iodure d'argent sur les stratus surfondus.** [Effect of silver iodide on supercooled stratus.] *Puy-de-Dôme. Observatoire, Bulletin*, Ser. 2, No. 2:33-40, April **1953.** 2 photos, 5 refs. **DWB**—Cloud seeding was carried out with an AgI generator during winter in the Limagne Plain which stretches between the chain of Domes to the west and the Forez Mountains to the east. During the time of seeding the size of cloud droplets was such as not to favor natural precipitation. Precipitation occurred from stratus, thickness of 100 m, with −5.5°C and always in the form of hexagonal columns or platelets. Precipitation of the order of cloud volumes of 1 km³ was produced and the visibility at the ground was increased from 80 m to 500 m. (*Same item as* 6J-158, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with silver iodide 2. Limagne Plain, France.**—*I.L.D.*

**11M-405** 551.509.617:551.578.7(44)

Dessens, H., **L'activité de l'Association d'Études des Moyens de Lutte contre les Fléaux Atmosphériques en 1953.** [Activity of the Research Association for the control of Weather Disasters in 1953.] *Puy-de-Dôme, Observatoire, Bulletin*, Ser. 2, No. 3:75 76, July **1953.** fig. **DWB**—Purified wood charcoal is steeped from 20 to 30 min in an acetone solution of NaI containing 20 gm AgI per liter. The carbon is uniformly impregnated to 1.5% of AgI (15 gm) per kg. During 1953, just as in 1951 and 1952, the Association concentrated its efforts on hail prevention by AgI seeding on a large scale. Vonnegut type generators were discontinued because of difficulty in using simultaneously and continuously for several days at 43 stations (shown on chart) on a 400 km line. A new technique recommended by General Electric and used in Africa by G. BIDAULT has been modified for use in France during 1953. Most of the stations (36) are in the S. W. part of France. Seven are around the Puy-de-Dôme Observatory. (*Same item as* 6J-159, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in France 2. Hail prevention in France 3. Cloud seeding with silver iodide.**—*M.R.*

**11M-406** 551.509.617(44)

Dessens, Henri (*Dir. Puy-de-Dome Obs.*), **Expériences de modification des nuages dans les Pyrénées.** (Cloud modification experiments in the Pyrenees.) *International Union of Geodesy and Geophysics. Association of Meteorology, Brussels, 1951, Procès-Verbaux des Séances, Mémoires et discussion*, pub. **1953.** p. 149. **DWB**—Short summary of paper presented at meeting. Seeding with hygroscopic nuclei was accomplished at 2000-3000 m in height, considering orographic conditions and prevailing wind currents. (*Same item as* 6J-160, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with hygroscopic nuclei 2. Condensation nuclei 3. Pyrenees, France,**—*A.A.*

**11M-407** 551.509.617:551.578.7

Dessens, H., **Les problèmes de la défense contre la grêle.** [Problems of hail control.] *Puy-de-Dôme, Observatoire, Bulletin*, Ser. 2, No. 3:73-74, July **1953.** **DWB**—A report on a press conference held at Locarno, Switzerland, on June 8, 1953, at which time the results of 5 years of intensive research into the efficiency of hail shooting methods were reviewed. The experiments were made on the Magadino Plain—a very fertile horticultural region 10 km long and 3 km wide, where hail often damages vineyards and tobacco plantations. The 1948-1952 data for 50 controlled hail shooting stations, when compared with 1943-47 data (when no shooting was undertaken) show

no significant difference in number of intensity of hailstorms in this area or other areas of similar topography. New experiments begun in May 1953 with 15 AgI seeding stations may give further information on success in combating hail. (*Same item as* 6J–161, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Hail shooting 2. Hail prevention in Switzerland 3. Cloud seeding in Switzerland 4. Magadino Plain, Switzerland.**—*M.R.*

**11M–408** 551.509.617(788)

Evans, T. H., **The present status of rainmaking.** *Public Works*, N. Y., No. 11:53, 126, Nov. **1953.** photo. **DLC**—Statistical analysis of rainfall during the past 2 or 3 years in Colorado and other western states made by the Engineering School of Colorado A. & M. failed to show any significant increase in precipitation which could be attributed to silver iodide seeding of clouds. Nor has there been any proof that the seeding in many cases has not been successful. Since results, if any, are on a small scale rather than the large scale at first envisioned, it will take years to come to any sound conclusion in this regard. The cautious attitude of the U. S. Weather Bureau toward enthusiastic claims in the early stages of the cloud seeding "boom" is commended. (*Same item as* 6.1–110 and 6J–162, *Met. Abs*) *Subject Headings:* **1. Artificial precipitation 2. Cloud seeding evaluation 3. Colorado.**—*M.R.*

**11M–409** 551.509.617(45)

Fea, Giorgio et al., **Esperienze di provocazione artificiale della pioggia.** [Experiments in the artificial production of rain.] *Rivista di Meteorologia Aeronautica*, 13(1):3–15, Jan./March **1953.** 12 figs., 10 refs. Italian, French, German and English summaries p. 3. **DLC**—A carefully planned attempt at inducing precipitation on the Sila Grande plateau (southern tip of Italy near Monte Scuro) is described and illustrated in detail. Laboratory experiments and climatological studies (monthly roses of winds aloft and total precipitation in region for season, average monthly height of zero isotherm, etc.) were carried out to determine the most effective manner, time and place for seeding and the most favorable synoptic situations. A topographic map and schematic cross section show cloud-silver iodide-zero isotherm and precipitation mechanics. Details of the 6 attempts (Oct. 22 to Nov. 1952?) and results of each are given with comment that they turned out as expected. However, in order to give quantitative statistical evaluation of success, a rain gage network 5 to 10 times as dense (1 to 4 $km^2$) as that used would be desirable. (*Same item as* 6.6–129 and 6J–163, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Italy 2. Cloud seeding with silver iodide 3. Sila Grande Plateau, Italy.**—*M.R.*

**11M–410** 551.509.617

Flohn, H., **Lassen sich die Wolken impfen?** [Can clouds be seeded?] *Übersicht*, Hannover, 4(5):442–444, May **1953. DA**—In a concise presentation of natural and artificial precipitation processes, the author shows that significant amounts of rain cannot be produced unless natural conditions (which cannot be modified) favor such precipitation. Claims of 7-day weather periodicities resulting from seeding are rejected; legal aspects are discussed; the battle: U. S. scientists vs. commercial interests is touched upon. (*Same item as* 6J–351, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Legal aspects of weather control.**—*G.T.*

**11M–411** 551.510.72:551.551.8

Goldberg, Paul G.; Parziale, A. J.; Faucher, Gerard; Manning, Bernard and Lettau, Heinz, **Silver iodide diffusion experiments conducted at Camp Wellfleet, Mass., during July-Aug. 1952.** *U. S. Air Force. Cambridge Research Center, Air Force Surveys in Geophysics*, No. 44, June **1953.** 26 p. figs., charts, tables, foot-refs., eqs. **DLC**—This report contains four studies dealing with the feasibility of utilizing air-borne equipment for detecting atmospheric conductivity to track radioactive smoke clouds emanating from ground generators and determining "operational requirements and procedures utilizing a two-curve radioactive source" ($AgI^{131}$) for scaling these factors in terms of a higher level radioactivity experiment (P. G. Goldberg); silver iodide diffusion experiments for the purpose of determining AgI particle trajectory, the efficiency of dispersing these particles in a free atmosphere (G. Faucher and A. J. Parziale); description of a method of producing AgI aerosols using very small amounts of radioactive AgI (Bernard Manning); and an evaluation of the experiments and results of the above experiments (Henry Lettau). (*Same item as* 8.1–382, Jan. 1957, *Met. Abs.*) *Subject Headings:* **1. Silver iodide diffusion 2. Silver iodide smoke generators 3. Radio active aerosols 4. Camp Wellfleet, Mass.**—*I.L.D.*

**11M–412** 551.509.68:539.17

Goldman, Robert P., **Do atom bombs change our weather?** *Science Digest*, 33(5):15–17, May **1953.** Condensed from *Parade*, N. Y., Jan. 18, **1953. DWB**—Popular explanation that there is no evidence of an effect of the atom bomb on weather, but the invisible clouds of radioactive particles, detected at more than 120 U. S. Weather Bureau stations are useful for the study of weather processes. *Subject Headings:* **1. Atomic explosion effects on weather 2. Radioactive clouds.**—*A.A.*

**11M–413** 551.509.617(794)

*Hall, Ferguson; Henderson, T. J. and Cundiff, Stuart A., **Cloud seeding operations in the Bishop Creek, Calif., watershed.** *U. S. Weather Bureau, Research Paper*, No. 36, Jan. **1953.** 29 p. 31 figs., 7 tables, 7 refs. Also condensed version as: **Cloud seeding in the Sierra near Bishop, California,** in *American Meteorological Society, Bulletin*, 34(3):111–116, March **1953.** 9 figs. **DWB**—A critical analysis of results of cloud seeding operations by dry ice carried out by the California Electric Power Co. in the High Sierras near Bishop, Calif. Runoff for the three years (1948–50) from the watershed into Bishop Creek is compared with runoff from nearby watersheds not affected by the seeded clouds, and with runoff for other years (1926–47 and 1917–47). Also the runoff for the 3 years when seeding was conducted is compared with what would be expected from snow survey measurements in the area. Only the 1948 and 1949 runoff was significantly greater in the seeded area, though the average for the 3 years was significant at 5% level; and a 9% increase in flow was indicated for the 3 years with 90% confidence limits between 0 and 18%. The outstanding 1949 values could have been due to 1949 having unusual circulation patterns affecting the immediate area. Less runoff actually occurred than would have been expected from prior snowpack. (*Same item as* 5.1–96 and 6J–164, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in California 2. Bishop, Calif.**—*M.R.*

**11M–414** 551.510.535:061.6 551.574.1:061.6

Higgs, A. J. (*Australian Sci. Liaison Off., Wash., D. C.*), **Radiophysics in Australia.** *Science*, 117(3031):3, Jan. 30, **1953.** **DWB**—The Radiophysics Lab. in Sydney began in 1949 as a wartime radar research establishment but is now famous for its peacetime work in radio astronomy and radar and is concerned with ionospheric and upper atmosphere investigations. Work in Australia on cloud physics and "rain making" was spectacular in the early stages (1947). Recently, good results have been obtained by the Laboratory in studies of rain from non-freezing clouds, and of the relative importance of coalescence in raindrop formation. (*Same item as* 5.2–94, Feb. 1954, *Met. Abs.*) *Subject Headings:* **1. Cloud physics research 2. Radiophysics Laboratory, Sydney, Australia. I. Australia Commonwealth Scientific and Industrial Research Organization.**—*M.R.*

**11M–415** 551.509.617(742)

*Howell, Wallace E., Associates Inc., Cambridge, Mass., **Evaluation of cloud seeding in the Androscoggin River Watershed for the Brown Company, Nov.–Dec. 1952.** Feb. 5, **1953.** 28 p. 2 maps (fold.), numerous charts (fold.) **DWB**—The trials which began Nov. 1 and ended Dec. 14, 1952 were made in the catchment areas above Berlin, N. H. Four fixed AgI generator stations were in operation during this period, but two more stations were established west of the area and one on Mt. Washington during mid-Nov., and the one to the east in Maine was discontinued at that time. Two mobile units were also used in the evaluation. Weather situations are described for each case and detailed charts show precipitation which occurred in the area. In each case a comment is made as to the probable effectiveness for particular generators or particular rainstorms. (*Same item as* 6.6–131 and 6J–165, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in New Hampshire 2. Androscoggin Watershed, N. H.**—*M.R.*

**11M–416** 551.509.617:551.577.3(85)

Howell, Wallace E., Associates, Inc., Cambridge, Mass., **Evaluation of cloud seeding in the Chicama-Moche region of Peru, for the period Sept. 1951–June 1953.** Dec. **1953.** 30 p. 4 tables, 19 figs., 12 maps. **DWB**—The first report (*see item* 11M–320) gives results of first season's operations from Sept. 1951 to June 1952. The present report gives results from July 1952 to June 1953 and an exhaustive analysis of results of both seasons. The AgI generators were set up on the ground at points near the Continental Divide. Rainfall 30% greater than expected (1 chance in 1000) is claimed for months with 25 hours or more of generator operation, while during months with no seeding a 7% increase (insignificant) occurred. Runoff was 24% and 10% less than expected in the same respective periods. (*Same item as* 5.11–59 and 6J–166, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Peru 2. Chicama-Moche Region, Peru.**—*M.R.*

**11M–417** 551.509.617:551.577.3(714)

Howell, Wallace E., Associates, Inc., Cambridge, Mass., **Evaluation of cloud seeding operations in the Lake St. John watershed for the Aluminum Company of Canada, Ltd.** March **1953.** 44 p. numerous charts (fold). **DWB**—Cloud seeding trials in Lake St. John, Quebec area from Aug. 9–Oct. 3, 1952 increased precipitation in that area by 15% or an additional 0.94" of rain in 8 weeks over 7000 sq mi area in target area "A" (northern portion); and 23% of 0.64" during 6 weeks from Oct. 29–Dec. 8, 1952 over 20,000 sq mi in area B (southern portion of Watershed). All told 45 billion cu ft of water were squeezed out of the clouds by Howell in that area. About 180 rainfall stations are used on isohyetal charts and in the evaluation. Weather conditions and seeding opera-

tions are described and evaluated for each day when seeding occurred. (*Same item as* 5.11–60 and 6J–167, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Quebec 2. Isohyetal charts 3. Lake St. John Watershed, Quebec.**—*M.R.*

**11M–418** 551.509.617:551.577.3(714)

Howell, Wallace E., Associates, Inc., Cambridge, Mass., **Evaluation of the cloud seeding operations in the St. Maurice River Watershed for the Shawinigan Water and Power Company, Nov. 11–Dec. 12, 1952.** April **1953.** 14 p. map, numerous charts (fold.). **DWB**—Silver iodide cloud seeding operations carried out in Quebec (north of St. Lawrence River) during Nov. and Dec. 1952 proved successful, as this report shows. Between Nov. 11 and Dec. 12, 1952 precipitation was increased by 12%, or a 0.46″ increase over 5100 sq mi, yielding 5 billion cu ft of water, all told. Each situation when seeding occurred is described synoptically and accompanied by charts showing precipitation which occurred within target area, using data for about 180 precipitation stations (list appended). (*Same item as* 5.11–61 and 6J–168, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Quebec 2. Isohyetal charts 3. Maurice River Watershed, Quebec.**—*M.R.*

**11M–419** 551.509.617(729.1)

*§Howell, Wallace E., Associates, Inc., Cambridge, Mass., **Evaluation report of 1952 rainfall stimulation program for Central Najasa.** [1953]. 7 p. 4 figs., 2 tables, numerous charts. **DWB**—Study gives daily isohyetal maps for seeding days with hodographs of upper winds, a map of isopercentals of relative anomaly and shows the location of rain gages and generators. A 33% increase of rainfall on the target area as compared with a control area was found. Probability of chance is small. (*Same item as* 5.8–82 and 6J–169, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Cuba 2. Central Najasa, Cuba.**—*A.A.*

**11M–420** 551.509.617(7291).

*§Howell, Wallace E., Associates, Inc., Cambridge, Mass., **Evaluation report of 1952 rainfall stimulation program for Macareño Industrial Corporation of New York.** [1953]. 7+p. 2 tables, 4 figs., numerous charts. **DWB**—Study gives daily isohyetal maps with hodographs of upper winds, a map of isopercentals of relative precipitation, and shows the location of rain gages and generators. A 35% increase of rainfall on the target area as compared with a control area was found. Probability of chance is <1:100. (*Same item as* 5.8–84 and 6J–170, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Cuba 2. Macareño, Cuba.**—*A.A.*

**11M–421** 551.509.617(729.1)

*§Howell, W. E., Associates, Inc., Cambridge, Mass., **Evaluation report of rainfall stimulation program for Central Ermita, May–Dec. 1952.** [1953.] 45 p. 4 figs., tables, numerous charts. **DWB**—Study gives daily isohyetal maps, during summer and winter operations, a map of isopercentals of normal rainfall, and shows the location of rain gages and generators. A 53% increase of rainfall on the target area as compared with a control area was found. This increase is 3.3 times as large as the standard deviation of observed deviations (probability of chance <1=1000). (*Same item as* 5.8–81 and 6J–171, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Cuba 2. Central Ermita, Cuba.**—*A.A.*

**11M–422** 551.509.617:632.187(714)

Howell, Wallace E., Associates, Inc., Cambridge, Mass., **Rainfall stimulation in connection with forest fire control, Forestville, Quebec, August 1953.** 1 p. chart. **DWB**—Cloud seeding with AgI was carried out from Aug. 12 to 23, 1953 in the Forestville, Quebec area, in an attempt at controlling a forest fire. Chart shows isohyets of rainfall on Aug. 22–24 in relation to fire area. Success was claimed to the extent that outside the seeding area <0.10″ of rain occurred whereas >0.25 to 0.92″ fell "within the area of stimulation and near the fire." (*Same item as* 6.6–132 and 6J–172, *Met. Abs.*) *Subject Headings.* **1. Cloud seeding with silver iodide 2. Forest fire control 3. Forestville, Quebec.**—*M.R.*

**11M–423** 551.509.617:6

Howell, Wallace E., Associates, Inc., Cambridge, Mass., **Rainmaking and industry.** [1953?] [12 p.] port., photos, diagr. **DWB**—A nicely illustrated brochure explaining the needs of agriculture and industry for controlled precipitation, the scientific basis for rainmaking, and answers to a number of questions raised by various interests on the practical and legal aspects of rainmaking. The general tenor of the answers is optimistic. Operations of Wallace E. Howell, Associates in various parts of the hemisphere (Canada, U. S., Cuba, Peru, etc.) are cited as a testimonial to the soundness of the experiments. (*Same item as* 6J–352, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Industrial meteorology 2. Artificial precipitation.**—*M.R.*

**11M–424** 551.509.617:551.579(747)

*Howell, Wallace E., Associates, Inc., Cambridge, Mass.. **Runoff evaluation of cloud seeding in the watersheds of the Stillwater Reservoir and of the Bennett's Bridge Salmon River Reservoir conducted during 1951 and 1952.** Nov. 1953. 8 p., 3 figs., table. DWB—Attempts at rainfall stimulation made in the watersheds of the Niagara-Mohawk Power Co. in Sept. and Nov. 1951 proved unsuccessful and attempts made from June–Nov. 1952 yielded 52 % more runoff than would be expected if relationship between control and target watersheds were directly proportional. Analysis of rainfall records proved that relation is not directly proportional, so a re-evaluation gave evidence of runoff increased by 53 % over expected amounts with reliability of 3 in one thousand. The Cranberry Lake and Hinckley watersheds were used as control areas. (*Same item as* 5.11–62 and 6J–173. *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in New York 2. Runoff evaluation 3. Northeastern New York (State).**—*M.R.*

**11M–425** 551.509.617:551.577.1(729.1)

*Howell, Wallace E., Associates, Inc., Cambridge, Mass.. **Summary evaluation of cloud seeding operations in Cuba, 1952.** April 1953. 19 p., 7 figs., 5 maps, refs.—Effects of cloud seeding operations conducted in five sugar plantations in Cuba are statistically analyzed. Using data from the target and control areas and normals for those areas, regression equations, correlation coefficients, standard errors and probability curves are computed. Results of the analysis are presented in charts and graphs. The author finds a significant increase of rainfall over the target areas and shows that the probability of such an increase under natural conditions is as small as 1:2,000. (*Same item as* 5.1–94 and 6J–174. *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Cuba 2. Precipitation distribution 3. Cuba.**—*G.T.*

**11M–426** 551.509.61 551.5(02)

**†Johnson, John Clark (*Research Lab. of Physical Electronics, Tufts College*). **Physical meteorology.** N. Y., John Wiley; London, Chapman and Hall. 1954. 393 p., numerous figs., tables, refs. at end of each chap., eqs. Price $7.50. **DLC** QC861.J6.—This modern textbook is the result of several years of teaching courses in physical meteorology at M. I. T. and research done by the author and colleagues at that institution. On p. 268–270, **The stimulation of precipitation by artificial means,** the three methods of 1. dry ice, 2. silver iodide, and 3. Bowen's condensation-coalescence process are described with their economical evaluation. For abstract covering entire book see 5.9–6. Sept. 1954 *Met. Abs.*) *Subject Heading:* **1. Physical meteorology textbooks.**—*M.R.*

**11M–427** 551.509.617(711)

Joy, Arthur F., **Rainmaker to industry.** *Flying*, Chicago, 53(3):33, 62–64, Sept. 1953. DWB—WALLACE E. HOWELL is, or has been, under contract to perform cloud seeding operations in several countries outside of the U. S. An example of the type of work he is doing in British Columbia, Canada for ALCAN, to provide a sufficient water supply for a huge aluminum refining development, is discussed. PAULIS PUTNINS, formerly of Riga, Latvia, is one of his chief meteorologists. (*Same item as* 6J–175 Oct. 1955. *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in British Columbia 2. Howell, Wallace E., Associates, Inc.**—*M.R.*

**11M–428** 551.509.617(47)

Kirgian, A. Kh., **Fizika atmosfery.** [Physics of the atmosphere.] Moscow. 1953. 456 p., 220 figs., 119 tables, refs., eqs. **DLC**—On p. 304–302 is a chapter on **Artificial effects on clouds and on precipitation formation.** In the U.S.S.R. the first experiments in this direction began in 1931–1932 in the Institutes of Experimental Meteorology in Leningrad and in Moscow under the guidance of V. N. OBOLENSKII and S. V. GORBACHEV. At present three methods of cloud seeding are known. The first method uses dry ice, i.e., solid carbon dioxide particles; it can produce a small shower from cumulus clouds. The second method uses the tiniest particles of AgI, which produce snowfall. The third method has been described by E. BOWEN: water drops are introduced into clouds at any temperature; falling down they collide with cloud droplets and grow rapidly. The idea of this method was developed by LANGMUIR. He assumed that a drop growing by coalescence to $r = 2.5$ mm. splits later into smaller droplets which are carried upward again by the ascending current in the cloud and the coalescence process expands and develops more and more like a chain reaction. (*Same item as* 6J–176. Oct. 1955. *Met. Abs.*) *Subject Heading:* **1. Artificial precipitation 2. U.S.S.R.**—*N.A.S.*

**11M–429** 551.509.617:016

†Krick, Irving P. (*comp.*). **Bibliography on weather modification and field operations, using the combined facilities of Irving P. Krick, American Institute of Aerological Research and Water Resources Development Corporation.** Denver, Colorado, American Institute of Aerological Research, March 25, 1953. unpaged. Mimeo. Also issued in: *Meteorological Abstracts and Bibliog-*

*raphy*, 4(8):963–968, Aug. 1953. **DWB**—A list of 104 lectures or reports prepared during 1947–1953, mostly for agencies contracting with the Water Resources Development Corp., on cloud seeding operations in various parts of the Western U. S. In the subject outline introducing this bibliography, these reports have been referred to by their serial number as found in the original listing. For KRICK's bibliography for 1947–1955, *see* 11M–618). (*Same item as* 6J–177, Oct. 1953, *Met. Abs.*) *Subject Headings:* **1. Weather modification bibliographies 2. Western United States. I. American Institute of Aerological Research II. Water Resources Development Corporation.**—*G. T.*

**11M–430** 551.509.617(764)

Krick, Irving P., **Cloud-seeding operations at Dallas.** *American Water Works Association, Journal*, 45(11):1144–1150, Nov. 1953. 6 figs., 2 tables, ref. **DLC**—The cloud seeding operation carried out at Dallas extended from Nov. 22, 1952 to May 22, 1953, and involved the operation of ground generators for approximately 870 hrs. Precipitation patterns associated with specific seeding operations are shown diagrammatically and indicate that in one seeding instance one thunderstorm produced as much rainfall as that normally received during an entire month. Data on percentage change in storage June 1 over Jan. 1, 1953 are given. The total precipitation for the period of seeding expressed as a percentage of normal precipitation for the same period was considerably higher in the target area than in the surrounding territory. (*Same item as* 6.2–47, and 6J–174, Met. Abs. *Subject Headings:* **1. Cloud seeding in Texas 2. Dallas, Texas.**—*I. L. D.*

**11M–431** 551.509.617(783)

Krick, Irving P. (*Water Resources Development Corp., Denver*). **Evidence of man-made climatic change.** *Western Snow Conference, 21st, Boise, Idaho, April 1953.* [pub. 1953?] p. 11–16. **Discussion** by Milton S. Sachs, *Ibid.*, p. 17–18. charts, ref. **DWB**—Deals with weather modification by cloud seeding. Seeding operations on the water divide of the Colorado, Arkansas and Rio Grande Rivers, extended over three years, resulted in a remarkable increase in snow pack up to 350% in a single year and up to 288% on the average, while neighboring areas received, in some cases, less than ever observed. Maps show the percentage in each year in relation to the normal water content of the snow. No original data are presented. SACHS points out that an independent evaluation committee found even a greater benefit than the operator claimed. (*Same item as* 6.6–133 and 6J–179, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Colorado 2. Colorado.**—*A. J.*

**11M–432** 551.509.617:551.577.33

*Langmuir, Irving, **Analysis of the effects of periodic seeding of the atmosphere with silver iodide.** General Electric Research Laboratory, Contract DA-36-039-sc-15345, Project Cirrus, Final Report, Pt. 2, May 1953. numerous tables, diagrs., foot-refs. Also: **Second revision of Chapter 12, and Errata.** (In Langmuir, I., **Widespread control of weather by silver iodide seeding.** *General Electric Research Lab., Report* No. 55-RL-1263, July 1955. p. 77–113 and 169–175. **Review** by L. Serra in *Puy de Dôme. Observatoire, Bulletin*, No. 3.86–87, July-Sept., 1954. **DWB**—This voluminous statistical report begins with the basic discoveries of SCHAEFER and LANGMUIR regarding the effects of dry ice and later of AgI seeding and cloud physics. The seeding of stratus and cumulus clouds, the widespread effects of seeding cumulus clouds and hurricanes; periodic seeding of clouds in New Mexico, methods of evaluating significance of 7-day periodicity in rainfall; periodicities in cloudiness, wind, pressure, tropopause height, temperature aloft; U. S. Weather Bureau studies on 7-day periodicities and, finally, 7-day periodicities and phase propagation over the U. S. occupy subsequent chapters. A great deal of tabular, graphical and statistical data are presented to support controversial claims of high significance. (For Pt. 1, *see* 11M–488. *Same item as* 6F–254 and 6J–180, *Met. Abs.*) *Subject Headings:* **1. Project Cirrus 2. Cloud seeding with silver iodide 3. Tropopause height variations 4. Rainfall periodicities.**—*M. R.*

**11M–433** 551.509.617:551.577.1(794)

*Lieberman, Gerald J., **Evaluation of the 1951–1952 cloud seeding experiment in Santa Clara County.** Stanford, Calif., Stanford Univ. [1953?] 21 p. tables, refs., eqs. **DWB**—A statistical method of rainfall evaluation based on storm totals is developed in detail and applied to records obtained in Santa Clara County during the period 1940–1951. It is found that the test failed to produce sufficient evidence as to the effectiveness of the cloud seeding operations investigated. The results of the procedure would probably have been significant if rainfall had been increased by 30%. (*Same item as* 5.2–79, Feb. 1954, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in California 2. Precipitation analysis 3. Santa Clara County, Calif.**—*G. T.*

**11M–434** 551.509.617:69

Linsley, Ray K., Jr., **Rainmaking—it worries contractors.** *Western Construction*, San Francisco, 28(3):60–62, 140, March 1953. fig., port., photo. **DLC**—Principles of cloud seeding and the

evaluation of its results are outlined. It is believed that "fluctional benefits of cloud seeding (if any) are in the order of 10% or less of natural rainfall." A determination of economic benefits would require more than a statistical evaluation of the type described by author, since cloud seeding is usually less effective during drought conditions and most effective when natural rainfall is sufficient (and added precipitation may even be harmful). Contractors should protect their interests by being informed of cloud seeding enterprises in their area, establishing records of their losses due to weather, and taking legal action against rainmakers, if warranted. (*Same item as* 6J-182, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding effects 2. Construction.**—*G.T.*

**11M-435** 551.509.617(09)

Loewe, Fritz. **Some forerunners of rainmaking by seeding of clouds.** *Weather*, 8(2):35-37, Feb. **1953.** 11 refs. **DWB**—A brief but informative article on the early history of rainmaking by methods similar to those applied today. GATHMAN took out a patent for cloud seeding with liquid carbonic acid (1891). A. BERG suggested cloud seeding with liquid air (1922) or big water drops (1926). FINDEISEN made cloud seeding flights in 1942-1944 (precipitation formation and cloud dissolution was observed). References are given to the original sources reporting these events. (*Same item as* 4.10-85 and 6J-183, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding techniques 2. History of weather control.**—*G.T.*

**11M-436** 551.509.617:398

McCarthy, Frederick D., **Aboriginal rain-makers.** *Weather*, 8(3):72-77, March **1953.** 4 figs. **DWB.** Also his article of same title in *Nature*, London, 170(4314):26-27, **1952. DWB.** Also his article of same title Pt. 1, in *Australian Museum Magazine*, Sydney, 10(8):249-252, Dec. 15, **1951** and Pt. 2, *Ibid.*, 10(9):302-305, March **1952.** photos. **DLC**—Description of rain-making rites in Australia, with photos, cult of the rainbow-serpent, blood-sprinkling, etc. and also rites for stopping rain. (*Same item as* 6.6-135, June 1955, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Folklore.**—*C.E.P.B.*

**11M-437** 551.574.1

McDonald, James E., **Theoretical cloud physics studies.** Iowa State College, Physics Dept., Contract Nonr757, T.O.(00), Project NR 082 093, Final Report, Jan. 31, **1953.** 105 p. figs., tables, eqs., bibliog. p. i-vi (following p. 105). Mimeo. **DWB**—This report contains 4 studies, each complete in itself, including an abstract summary and suggestions for future research. The first and longest paper entitled **Homogeneous nucleation of supercooled water drops,** develops the theory needed to explain the spontaneous freezing of supercooled water drops at −38°C to −41°C as distinguished from heterogeneous freezing at higher temperatures, such as is found on aircraft flying through supercooled clouds, or in artificial nucleation of clouds. The theory gives −26°C as the probable temperature of homogeneous freezing, but this is thought to be close enough to −40°C to verify the theory. The second paper is **On the electrical conductivity of the lower stratosphere.** The third paper is entitled **A note on erroneous cloud physical application of Raoult's law,** paper number 4 is entitled **The shape and aerodynamics of large raindrops.** (For fuller abstract *see item* 4.11-3, Nov. 1953, *Met. Abs.*) *Subject Headings:* **1. Cloud physics research 2. Spontaneous freezing 3. Electrical conductivity in stratosphere 4. Condensation nuclei 5. Raindrop distortion.**—*M.R.*

**11M-438** 551.574.1:551.509.617

Magono, Choji, **Extraction from literature on artificial production of precipitation.** *Researches on Snow and Ice*, Tokyo, No. 1:227-230, Oct. **1953.** In Japanese. **DWB**—Review of 4 papers on cloud physics: FINDEISEN (1938), SCHAEFER (1951), COONS and GUNN (1951), and a group of papers on cloud seeding. (*Same item as* 6F-260, June 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud physics 2. Cloud seeding.**—*M.R.*

**11M-439** 551.509.617:551.574.1:551.577.11

Mason, B. J., **The natural and artificial production of rain.** *Royal College of Science, Scientific Journal*, 22, **1953.** 14 p. 5 figs. Abstracted from reprint. **DWB**—General lecture on processes of cloud formation, mechanisms of precipitation release (coalescence, ice crystal). Precipitation mechanisms are shown in diagram form. Techniques of rain making are set out, and it is concluded that it is often possible to release some precipitation from suitable clouds by seeding, causing local changes in distribution but not in the general level of rainfall. (*Same item as* 5.4-72 and 6F-266, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding 2. Precipitation formation.**—*C.E.P.B.*

**11M-440** 551.578.41:551.574.1

Mason, Basil John, **Künstliche Schneekristalle dienen der Erforschung atmosphärischer Vorgänge.** [Artificial snow crystals aid the investigation of atmospheric processes.] *Die Umschau*,

53(1):15–17. Jan. 1, 1953. 12 figs., table, 3 refs. **DLC**—This interesting article describes laboratory experiments in which snow crystals were formed under conditions resembling nature. Crystals formed with or without nuclei of AgI or dry ice in a cloud of small water drops at 0 to −40°C were collected on glass slides and covered with transparent plastic. Crystal forms are tabulated according to temperature. Growth was also microfilmed on polished metal plates cooled to different temperatures or on glass slides. The article is illustrated by excellent microphotographs with scales. *Subject Heading:* **1. Snow crystal formation.**—*C.E.P.B.*

**11M–441** 551.509.617(789)

New Mexico Institute of Mining and Technology. Research and Development Div., Socorro, N. M., **Water resources development: Final Research Report. 1953. DWB**—The following papers in this report deal directly with cloud seeding operations: Sec. I: Hume, William H, **Induced precipitation.** (44 p. 4 figs., 8 plates, 2 tables, refs.) Starting with an outline on the physics of precipitation, the author describes the research activities of the project. A "cloud census" of New Mexico clouds was attempted and the effects of environment on sublimation nuclei, as well as the growth of ice crystals were studied. The practical use of silver iodide generators and balloons with dry ice is described. Summer and winter seeding operations are summarized. Appendix A (see item 11M–230 above). Appendix E: Workman, E. J., **Some observations bearing on the physical basis for cloud seeding.—Nature and the question of rainmaking.—Possible role of residual atmospheric ice in middle latitude precipitation.** (26 p. 4 figs.) Three papers presented at meetings. In the first paper the author points out that a synoptic analysis is not sufficient in order to determine the possibility of precipitation and gives an outline of the physical processes involved. A statistical analysis of laboratory experiments shows that the number of nuclei per $m^3$ increases with decreasing temperature and perhaps has a maximum between −26 and −27°C. Radar returns from cloud tops start at −16°C according to 80 samples. The second paper deals with climatic fluctuations (El Paso, 1911–1950), seasonal variability of rainfall, and gives a general outline of cloud seeding problems. A statistical probability study of precipitation from clouds with different top heights is presented (400 cases). Almost no precipitation if top is under 22,000 ft. The third paper emphasizes the nucleation by ice particles. (*Same item as* 5.4–73 and 6J 184, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in New Mexico 2. Cloud physics 3. Climate of New Mexico 4. New Mexico.**—*A.A.*

**11M–442** 551.509.6:351(795)

Oregon. Legislative Assembly. Interim Committee on Weather Control, **Weather modification: report.** (Salem), Jan. 7, **1953.** 24 p. refs. **DLC, DWB**—A thorough study of weather modification possibilities (by E. M. NELSON) and developments (by JOHN DAY), legal aspects and an appraisal of actual results in cloud seeding, followed by recommendation for further study (by R. T. BEAUMONT) and a draft of a bill for regulating weather modification and control activities in Oregon. The law sets up a Weather Modification Board consisting of the State Engineer, the Director of Agriculture, a member of the Oregon State College Faculty to be appointed by the College president and 2 members to be appointed by the Governor; terms of office to be 4 years. (*Same item as* 8.8–175, Aug. 1957, *Met. Abs.*) *Subject Headings:* **1. Weather modification reports 2. Weather control legislation 3. Oregon. I. Nelson, E. M. II. Day, John III. Beaumont, R. T.**—*M.R.*

**11M–443** 551.509.617(45)

Pellisari, L., **La protezione antigrandine in Italia.** [Hail prevention in Italy.] *Rivista di Meteorologia Aeronautica*, 13(1):52–53, Jan. March **1953. DWB**—Hail prevention activities in Italy by means of rockets are reviewed. In 1952 they show considerable territorial expansion over previous years (the program was initiated in 1949). Out of 355 predicted hailstorms against which action was taken, only 32 developed despite intervention, while all the others subsided. Even in the 32 negative cases failure was mostly due to reparable short comings. Rockets reaching higher altitudes (1,500 m) were introduced at several locations; their large-scale use will eliminate one of the major sources of failure. (*Same item as* 5.4–75, April 1954, *Met. Abs.*) *Subject Headings:* **1. Hail prevention in Italy 2. Italy.**—*G.T.*

**11M–444** 551.509.617

Quate, Boyd, **Weather modification as applied to hail storms.** *National Association of Mutual Insurance Companies, 57th Annual Convention, San Francisco, California, Oct. 11–15, 1953, Proceedings and Papers*, p. 192–195. **DWB**—Contains an account of the origin of the Water Resource Development Corporation of which IRVING P. KRICK is president and a simplified account of cloud seeding with AgI, the relationship between ice-crystal formation and precipitation, and the possible use of AgI cloud seeding to reduce hailstone size and to diminish hail damage. (*Same item as* 6.5–82 and

5J–185, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with silver iodide 2. Hail prevention 3. Water Resources Development Corp.**—*I.L.D.*

**11M–445** 551.509.617(794)

Reynolds, Robin R. (*Div. Water Resources, Dept. Public Works, Calif.*), **An evaluation of weather modification operations in California.** *National Reclamation Association, Washington, D. C., 22nd Annual Meeting, Reno, Nevada, Oct. 14,15,16, 1953, Proceedings*, pub. **1953.** p. 51–58. **DA**—Reviews various methods of cloud seeding evaluation and describes the one used by the California Division of Water Resources in evaluating cloud seeding experiments in California (1946–1951). The method adopted is a statistical one, based on comparison of rainfall amounts in target and control area during the five seeded and five unseeded years. The results are inconclusive for several areas but it is found that "within the statistical framework and for the particular years which were used the rainfall increases in Santa Barbara County are significant." The author believes that with this method of evaluation a final answer to the problem of an effectiveness of rainmaking may be found on the basis of data from 5–10 years of systematic cloud-seeding operations. (*Same item as* 6J–187, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding evaluation 2. Cloud seeding in California 3. California.**—*G.T.*

**11M–446** 551.509.617:551.578.7(44)

Ruby, F., **Les nouvelles méthodes de défense contre la grêle.** [New methods of hail prevention.] *La Météorologie*, Paris, 4th Ser., No. 29:61–72, Jan./March **1953.** French, English and Spanish summaries p. 61.—The physics of hail formation is first discussed in detail and then several methods of hail prevention, including the old method of hail shooting (rockets, etc.) which was said to be 50 to 60% successful, and a new method of including AgI in the explosive charge of the rocket (rather than the inefficient ground generators) so that it would cause the cloud to precipitate prematurely, i.e., before the violent hail eddies had developed. Results obtained by the author and Météorologie Nationale since 1936, which are available in detail, are summarized. Author claims 100% success when AgI rockets are used (both for hail prevention and rain making). (*Same item as* 6.6–138 and 6J 188, *Met. Abs.*) *Subject Headings:* **1. Hail shooting 2. Artificial precipitation 3. Hail prevention in France 4. Silver iodide rockets 5. France.**—*M.R.*

**11M–447** 551.509.617:551.578.7(45)

Rui, D. and Romanelli, O., **Quattro anni di sperimentazioni antigrandine in Italia.** [Four years of hail prevention experiments in Italy.] Verona, Grafiche Testi, **1953.** 7 p. **DA**—Brief summary of the history of hail suppression experiments in Italy by means of explosive rockets. The first project was started in 1949. Since that time the area protected was considerably increased and the quality of rockets and arrangement of launching stations improved. Results of the operations are not indicated in this report. (*Same item as* 6J–189, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Hail prevention in Italy 2. Hail shooting 3. Italy.**—*G.T.*

**11M–448** 551.574.1:551.509.61

†Schaefer, Vincent J., **Laboratory, field, and flight experiments.** General Electric Research Laboratory, Contract DA-36-039-sc-15345, Project DA-3-90-07-022 (Project Cirrus), Final Report, Pt. 1, March **1953.** 170 p. 4 tables, figs., 75 refs. **DWB**—Project Cirrus continues from Feb. 28, 1947 to Sept. 30, 1952 under Office of Naval Research and U. S. Army Signal Crops contract. The principal scientists were Irving Langmuir, Vincent J. Schaefer and Bernard Vonnegut. Numerous reports and scientific articles have been issued, but this comprehensive illustrated report summarizes them all and gives details of the history of the research (going back to General Electric studies on gas masks and chemical fogs in 1940–42) and icing studies on Mt. Washington in 1953. The first cold chamber experiment was made in July 1946 and the first cloud seeding on Nov. 13, 1946. Details of laboratory, field and flight experiments are treated in a systematic manner. (For Pt. 2 *see* 11M–432.) (*Same item as* 6F–275 and 6J–190, *Met. Abs.*) *Subject Headings:* **1. Project Cirrus 2. Cloud seeding research 3. History of cloud seeding 4. Cloud physics.**—*M.R.*

**11M–449** 551.574.1:551.509.617

Sciarra Mortola, Luisa, **La microfisica delle nubi ed il controllo artificiale delle precipitazione.** [Microphysics of clouds and artificial control of precipitation.] *Geofisica e Meteorologia*, Genoa, 1(1):5–8, Jan./Feb. **1953.** fig. **DWB**—Genesis and nature of condensation nuclei, their size and the role they play in natural and artificial precipitation processes are theoretically discussed using data and conclusions of other authors like H. Israel, H. Köhler, W. Findeisen, E. G. Bowen, etc. A very instructive diagram shows schematic distribution of masses and sizes of atmospheric aerosol particles classified into several groups of nuclei and ions. (*Same item as* 4.9–161 and 6I–88, *Met. Abs.*) *Subject Headings:* **1. Nuclei theories 2. Nuclei sources 3. Nuclei mass 4. Nuclei size distribution 5. Ion size distribution.**—*N.A.S.*

**11M–450** 551.574.2:551.578.41

Serpolay, R., **Sur une technique de génération artificielle des cristaux de glace.** [Technique of artificial production of ice crystals.] *Puy-de-Dôme. Observatoire, Bulletin*, Ser. 2, No. 3:65–72, July **1953.** 12 figs., 7 refs. **DWB**—An aqueous solution of moistened crystals of AgI prepared from an acetone solution produces ice crystals in supercooled clouds ($-3°C$ to 13°C) in the same way AgI smoke does. It is thought that the electrical charges produced by the droplets of AgI solution falling through the cloud provide the mechanism for precipitation formation. This method has been tried in a modified form in Algeria by DUCELLIER, and can be used in further laboratory investigations of freezing nuclei and crystallization processes. (*Same item as* 6J 191, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with silver iodide 2. Ice nuclei formation.**—*M.R.*

**11M–451** 551.509.617(44)

Siriez, Henri, **L'agriculture et les calamités atmosphériques. I. La lutte contre la grêle.** [Agriculture and weather disasters. I. Hail control.] *Cahiers Français d'Information*, No. 231:4–6, July 1, **1953. II. Aspects législatifs et administratifs de la lutte contre la grêle et la gelée.** [II. The legislative and administrative aspects of hail and frost control.] *Ibid.*, No. 232:11–13, July 15, **1953.** refs. **DA**—In the first part of the paper statements made by FACY and DESSENS are reproduced *in extenso*. According to these statements the problem of hail control is still in the experimental stage. This shows that meteorologists do not agree with RUBY in his belief that hail control techniques presently used in France (explosive rockets) are effective and will be further enhanced by the use of silver iodide rockets. The second part of the article criticizes legislation concerning hail control. (*Same item as* 6J 192, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Hail prevention in France 2. Hail control legislation 3. France.**—*G.T.*

**11M–452** 551.509.617:551.577(789)

Smith, Theodore B., **On the area-time characteristics of rainfall variability. Detection of precipitation increases.** Pasadena, California, American Institute of Aerological Research, July **1953.** 4 refs. Typescript. **DWB**—In order to properly evaluate cloud seeding effectiveness, it is necessary to have reliable tests of rainfall variability over an area and for a considerable period of time. The optimum time, number of stations in an area and type of station to choose can be determined from statistical studies such as reported in this manuscript, based on data for 1929 to 1948 for 44 stations in N. E. New Mexico. The two sections of the study attempt (1) to investigate test conditions under which natural variability can be minimized for a given test and (2) to obtain a measured variability for various tests so that they can be compared with each other. (*Same item as* 6J–193, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding evaluation 2. Rainfall variations 3. New Mexico.**—*M.R.*

**11M–453** 551.509.617(522)

†*Terada, Kazuhiko (*Dir. Nagasaki Marine Obs.*) et al., **On the artificial stimulation of rain in the Kyushu area.** *Oceanography and Meteorology*, Nagasaki, Japan, 6(1):19–88, **1952/53.** graphs, diagrs., tables, plates, bibliog. p. 38–39. In Japanese; English summary p. 79–88. **MH, BH**—The first part deals with artificial production of rime, the second gives a detailed report on experimental stimulation of rain. Dry ice, 1.5 kg each time, was introduced into the atmosphere by balloon and released in a fixed layer. The probable path of the balloon was traced by means of all available aerological information. Precipitation measured in the area of the path indicates that the experiment was rather successful, although it is impossible to determine whether reported meteorological changes were artificial or natural. (*Same item as* 5.1–100 and 6J–194, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with dry ice 2. Rime 3. Kyushu, Japan.**—*A.A.*

**11M–454** 551.509.617

Tixeront, J., **Sur les expériences executées en Tunisie au sujet de la pluie provoquée.** [Experiments on artificial precipitation carried out in Tunisia.] *Puy-de-Dôme. Observatoire, Bulletin*, Ser. 2, No. 1:24–26, Jan. **1953.** ref.—The results of cloud seeding with $CaCl_2$ carried out from 1948 to 1950 in Tunis are summarized. The author concludes that seeding produced cloud modifications and rain each time but that no explanation can be given for the process. An outline for experimental seeding procedures for further study is given. (*Same item as* 6J–195, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with calcium chloride 2. Tunisia.**—*I.L.D.*

**11M–455** 551.509.6:34

U. S. Congress. House Committee on Interstate and Foreign Commerce, **Weather modification experiments. Hearing before the Committee . . . 83rd Congress, 1st Session, on H.R. 1064 and H.R. 2580, Bills to create a committee to study and evaluate public and private experiments in weather modification; H.R. 1584, a bill to authorize the Secretary of Commerce to provide for research and study and in cooperation with the States, to establish appropriate safeguards, with respect**

to weather modification operations and the problems related thereto; S. 285, an act to create a committee to study and evaluate public and private experiments in weather modification. July 28, 1953. Wash., D. C., Govt. Print. Off., 1953. 45 p. **DLC**—In addition to text of the 3 bills, the document contains reports of Depts. of Agriculture, Health and Welfare, Army and State, Civil Service Commission, Budget Bureau National Science Foundation, American Meteorological Society, etc. on the 3 weather modification committee bills or on the feasibility of weather control in general. Statements by D. M. LITTLE, SENATOR CASE and others are also included. (*Same item as* 6J 112 and 6J-196, *Met. Abs.*) *Subject Headings:* **1. U. S. Advisory Committee on Weather Control 2. Weather control legislation.**—*M.R.*

**11M-456** 551.509.6:34

U. S. Laws, statutes, etc., **An act to create a committee to study and evaluate public and private experiments in weather modification. Public Law 256, 83rd Congress, 1st Session, S. 285.** Approved Aug. 13, 1953. 4 p. **DWB**—This law specifies the aims of the committee, the composition (both federal and private authorities), the frequency of meetings, employees, hearings which may be conducted, demands for information from government agencies or private operators, periodic reports and lastly the final report which shall inform Congress on the "advisability of the Federal Government regulating by means of license or otherwise those who attempt to engage in activities designed to modify or control the weather." (*Same item as* 6J-197, Oct. 1955, *Met. Abs*). *Subject Headings:* **1. U. S. Advisory Committee on Weather Control 2. Cloud seeding evaluation 3. Weather control legislation.**—*M.R.*

**11M-457** 551.509.617

Vernon, Edward M., **What's wrong with the weather.** *National Association of Mutual Insurance Companies, Fifty-seventh Annual Convention, San Francisco, Oct. 11-15, 1953, Proceedings and Papers*, pub. 1953. p. 205-208. **DWB**—This address is largely a paraphrase of the statement of weather modification, especially cloud seeding, issued by the American Meteorological Society in April 1953. A brief summary of the cloud seeding experiments of E. G. BOWEN is given. (*Same item as* 6J 199, Oct. 1955, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding.**—*I.L.D.*

**11M-458** 551.578.71:551.509.617

Weickmann, Helmut, **Entstehung und Bekämpfung des Hagels.** [Formation and prevention of hail.] *Meteorologische Rundschau*, 6(9/10):175-180, Sept./Oct. 1953. 4 figs., 2 tables, 20 refs. Dessens, H., [**Review**] in: *Puy-de-Dôme. Observatoire, Bulletin*, No. 1:20-23, Jan./March 1955. Weickmann, H., [**Reply**]. *Ibid.*, No. 2:33-36, April/June 1955. **DWB**—From an analysis of the physical structure of a CuNb it is calculated that a hailstone growing from 1-10 mm diameter must pass through 2700 m cloud of water content 7.5 g/m³, taking about 7 min. To grow to 30 mm it must pass through 11,700 m cloud in 19 min or proportionately less for higher water content. A necessary condition is an upward current of at least 9 m/s throughout the cloud. Such extreme conditions cannot be effectively influenced by artificial means (*same item as* 6F-280, June 1955, *MAB*). In his **Reply,** Weickmann re-emphasizes two basic concepts contained in his paper: 1) "to show through the analysis of the microphysical conditions in a thunder- or hailstorm that the Bergeron-Findeisen mechanism cannot be applied blind-foldedly for the explanation of precipitation in thunderstorms"; and 2) "to show how the means which we apply in the fight against hail may just as well backfire and produce a larger hailfall." (*Same item as* 6J-200, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Hail formation 2. Hail prevention.**—*C.E.P.B., G.T.*

**11M-459** 551.509.617

Workman, E. J. (*N. M. School of Mines*), **Expert clarifies Southwest rainmaking status and present problems of future.** *New Mexico Stockman*, 18(11):26, 50, Nov. 1953. **DA**—Emphasizes need for more study of the physics and especially the thermodynamics of cloud and precipitation formation and warns of the dangers of certain cloud seeding techniques: "If silver iodide acts like it is supposed to act, and if it is dispensed over a large area in quantities sufficient to be significant for the purposes of rainmaking, it will induce irreversible processes in immature clouds which will decrease the thermodynamic potential of the local system and thereby decrease the probability of the development of a precipitating thunderstorm." (*Same item as* 6J-201, Oct. 1955, *Met. Abs.*) *Subject Heading:* **1. Weather control.**—*G.T.*

**11M-460** 551.577:551.509.617:628(791)

**Arizona has rain aplenty, first time in decade.** *Engineering News-Record*, 150(5):37, Jan. 29, 1953. **DLC**—Brief note on the improvement of the water balance in Arizona. At the start of 1952, after a dry decade, Salt River Valley Project reservoirs which have a capacity of 2 million acre-ft, held only 249,707 acre-ft of water. By the end of 1952 this figure had increased to 1,400,000. Attention is called to the fact that this was a year of extensive rainmaking activities. (*Same item as*

4.8–188, Aug. 1953, *Met. Abs.*) *Subject Headings:* **1. Rainfall 2. Artificial precipitation 3. Water resources 4. Arizona.**—*G.T.*

**11M–461** 551.509.68

**Let's talk about the weather.** *U. S. News & World Report*, Wash., D. C., 34(22):43–44, May 29, **1953.** illus. **DWB**—Unusual weather development throughout the U. S. during the early months of 1953 is reviewed. U. S. Atomic Energy Commission and U. S. Weather Bureau are quoted as rejecting the theory which attributes large scale weather effects to nuclear explosions in Nevada. *Subject Headings:* **1. Weather anomalies 2. Artificial influences on weather 3. Atomic explosion effects on weather.**—*G.T.*

**11M–462** 551.509.617(791)

**Rain-making efforts are continued in Arizona.** *Engineering News Record*, 150(2):35, Jan. 8, **1953. DLC**—Rain making experiments which have been conducted for two years by the Salt River Valley Water Users Assoc. are reported. Sixteen AgI ground generators are used in these experiments. Their operation is described. The construction cost of a generator is about $100. Although there are no data available on the effect of the experiments, it is believed that total rainfall has increased. R. J. McMullin, general manager, is quoted as declaring that the Association feels justified in continuing the program. The technique applied was developed by Jake West, chief hydrographer for the Association and his assistant, Borden Goodwin. (*Same item as* 4.9–59 and 6J–186, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Arizona 2. Silver iodide smoke generators 3. Arizona.** —*G.T.*

**11M–463** 551.509.33 551.509.617(73)

**Tomorrow's weather.** *Fortune*, Chicago, 47(5):144–149, 171–178, May **1953.** Photos, illus. (some in color), diagrs. **DWB**—Another comprehensive, semipopular insight into the conflict of opinions between official, scientific and commercial meteorologists in the United States, apparently written by a well-informed person. The main topics are long range forecasts, presenting sample forecasts by Namias and Krick who claim to be able to make detailed forecasts months in advance and cloud seeding, discussing the controversy between Langmuir (seven-day periodicities) and the U. S. Weather Bureau which started careful experiments. Other extreme poles of opinion exist between the electronic prediction method of von Neumann and Charney and the statistical approach of Wadsworth. (*Same item as* 6.2–82, Feb. 1955, *Met. Abs.*) *Subject Headings:* **1. Meteorological research 2. Industrial meteorology 3. Cloud seeding 4. Long range forecasting 5. United States.**—*A.A.*

**11M–464** 551.509.6:34

**U. S. to do something about the weather.** *New York Times*, Dec. **10, 1953.** p. 1, 95. Port. **DLC**—Aims of the Weather Evaluation Board which was authorized by Congress, and names of the chairman (Capt. H. T. Orville, U. S. N., ret.) and four members appointed by the President are announced. The principal task of the Board is to prepare a report (not later than June 30, 1956) containing an evaluation of the various effects of weather modification activities and recommendations for their effective control. (*Same item as* 6J–198, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. U. S. Advisory Committee on Weather Control 2. Weather control legislation.**—*G.T.*

## 1954

**11M–465** 551.509.617

†Absalom, H. W. L., **Artificial production of precipitation.** *Great Britain. Meteorological Research Committee, M.R.P.* 854, Feb. **27, 1954.** 12 p. 21 refs. Mimeo. **DWB**—The processes involved in natural precipitation are outlined. Rain-making procedures are classified as: dry ice, silver iodide, water drops and hygroscopic material. The need for proper statistical evaluation of results is emphasized. The results of experiments or operations in Africa, America and Australia are described and the conclusion is reached that a definite decision cannot yet be given as to the power of any of the methods to give useful amounts of precipitation. A good bibliography is appended. (*Same item as* 6J–202, Oct. 1955, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding.**—*C.E.P.B.*

**11M–466** 551.509.617(549)

Ahmed, Syed, **Rain making in Pakistan.** *Pakistan Review of Agriculture*, Karachi, No. 1:34–35, **1954. DA**—Report on the cloud physics project in Pakistan directed by E. M. Fournier d'Albe under the sponsorship of the U. N. Technical Assistance Programme. Work has been in progress on the first two phases of research: 1) determination of number of natural condensation nuclei and 2) information on frequency of cloud formations suitable for seeding. It is now entering the third phase (experiments on the effect of cloud seeding). (*Same item as* 6J–203, Oct. 1955, *Met.*

*Abs.*) *Subject Headings:* **1. Cloud seeding in Pakistan 2. Cloud seeding research 3. United Nations Technical Assistance Programme 4. Pakistan. I. Fournier d'Albe, E. M.**—*G.T.*

**11M–467** 551.509.617:551.578.71(44,494)

Albani, Felix, **Lucha antigranizo en Europa.** [Hail control in Europe.] *Meteoros*, Buenos Aires, 4(3):245, July/Sept. **1954. DWB**—A review of various attempts at hail prevention carried out in France and Switzerland, and of experimental studies on the mechanism of hail formation. (*Same item as* 8.7-141, July 1957, *Met. Abs.*) *Subject Headings:* **1. Hail prevention 2. Hail formation 3. France 4. Switzerland.**—*I.L.D.*

**11M–468** 551.509.617

American Meteorological Society, **The current status of evaluation of commercial cloud seeding operations.** [Papers presented at the Society's 134th National Meeting, Dec. 28–30, **1954.**] Photostat of typescript. unpaged. Contains: Lincoln, R. L., **Sensitivity of techniques applied to Tri-Counties, Oregon, Operations.** Decker, Fred W., **The need for designed and controlled experiments in cloud seeding.** Day, John A., **The outline of a controlled experiment designed for optimum evaluation.** Discussion. Abstracts in *American Meteorological Society, Bulletin*, 35(9):447–448, Nov. **1954. DWB**—The first paper describes an evaluation technique sensitive enough to establish the significance of a 16% increase over expected rainfall (the actual increase in the data analyzed was only one third of this). The second paper discusses a system of regression equations utilizing all weather factors related to the factor being modified. The third paper suggests requirements for cloud seeding experiments which should provide adequate data for evaluation purposes. (*Same item as* 6J-225, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding evaluation.**—*G.T.*

**11M–469** 551.509.617(44)

Apenzeller, F., **L'eau à portée de votre main.** [Water within your reach.] *Agriculture Pratique*, Paris, 118(5):251–253, May **1954. DA**—The cloud seeding technique developed by I. P. KRICK and his American Institute of Aerological Research and put into large-scale operation by Water Resources Development Corporation is explained. Spectacular results of the operation are cited. WRDC has offered to undertake rainmaking in France over an area of some 1 million hectares. The author believes that this opportunity to remedy the certainly existing water shortage by a method of proven merit should not be passed up. (*Same item as* 6J–205, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in France 2. France.**—*G.T.*

**11M–470** 551.509.6

†Arenberg, Kenneth M.; Bemis, F. Gregg, Jr.; Cushman, Chandler A. et al, **Weather modification: past, present and future.** Weymouth, Mass., Weymouth Gazette Press, **1954.** 49 p. diagrs., photos, refs. biblio. p. 46–48. Obtainable from Weather Modification Group, 270 Beach Street, Wollaston, Mass. "Written in partial fulfillment of the requirements for the course, Manufacturing, Graduate School of Business Administration, Harvard Univ." Review in *Weatherwise*, 7(3):74, June **1954. DLC**—The most complete and systematic treatise on weather modification (cloud seeding and rain making) published to date. This monograph covers: 1) history from earliest times, 2) scientific studies and background information on cloud physics, 3) statistical methods of evaluation of results, 4) various government (military, U. S. Weather Bureau and other) activities in weather modification, 5) commercial activities, 6) legal aspects (regulations), 7) potential application and importance. Conclusions are that some success has been obtained and more will be achieved, but economic value has yet to be proved. A chronology of Weather Bureau activities and a good bibliography are appended. (*Same item as* 6J–206, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Weather control 2. Cloud seeding evaluation 3. Weather modification bibliographies. I. Neisser, Edward II. Thomas, Gerrard P. III. Vetterlein, Donald H.**—*M.R.*

**11M–471** 551.509.617(52)

Asada, T. (*Osaka Univ.*), **Artificial rain-making in Kansai district.** *Committee for Rain-making in Japan, Tokyo, Report of Rain-making in Japan*, 1:24–27, **1954.** fig. **DWB**—Cloud-seeding experiments made in summer 1952 in Kansai District by means of ground generators (AgI and $Al_2O_3$) are reported to have resulted in a statistically significant increase of rainfall in the seeded area. On the basis of this routine seeding operations are now being conducted by the Kansai Electric Power Company, with continuing positive results. (*Same item as* 6J–207, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with silver iodide 2. Cloud seeding with aluminum oxide 3. Kansai District, Japan.**—*G.T.*

**11M–472** 551.509.617(52)

Asada, T.; Saito, H.; Sawai, T. and Matsumoto, S., **Some experiments of artificial rain-making.** *Committee for Rainmaking in Japan, Tokyo, Report of Rain-making in Japan*, 1:81-96, **1954.** 5 figs.,

3 refs. **DWB**—Aluminum oxide and silver iodide were found to be equally effective as ice nuclei both in cold-chamber experiments and under natural conditions. Field experiments made with both nucleating agents on Oki Island (Dec. 1952–Feb. 1953) are described in detail. As a result of a statistical analysis rainfall in the seeded area is claimed to have exceeded that in the control area by 20%. (*Same item as* 6J–208, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with silver iodide 2. Cloud seeding with aluminum oxide 3. Cloud seeding in Japan 4. Oki Island, Japan** —*G.T.*

**11M–473** 551.509.617:551.578.7(45)

Audisio, Walter, **Per una efficace difesa antigrandine.** [For effective hail control.] *Riforma Agraria*, Rome, 2(9):21–22, Sept. **1954. DA**—Review of the history of hail suppression activities from early hail-shooting practices to the present explosive rocket technique. Legal, organizational and economic aspects of hail rocket projects are discussed. Failure of Swiss hail suppression project (first series of experiments in Magadino Plain) possibly due to small size of rockets used. Author recommends AgI experiments in Italy, similar to those now initiated in Switzerland. (*Same item as* 6J–209, Oct. 1955, *Met. Abs.*) *Subject Heading:* **1. Hail prevention in Italy.**—*G.T.*

**11M–474** 551.509.617(691)

Augustin, H., **Les expériences de pluie artificielle effectuées à Madagascar en 1953.** [Experiments on the effectiveness of artificial rain in Madagascar in 1953.] *Pan Indian Ocean Science Congress, Aug. 1954, Perth, Western Australia, Proceedings of Section A, Physical Sciences*, p. 86–87. table, 3 refs. **DWB** (506.35 P187pr)—Cloud seeding in order to create artificial rain had been experimented with in Madagascar during 1953. The effects of the artificial rains are discussed. A tabulation of the results of the investigation and a list of the data papers are given. (*Same item as* 11.9–231, Sept. 1960, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation reports 2. Cloud seeding techniques 3. Madagascar.**—*N.N.*

**11M–475** 551.509.617(691)

*Augustin, Henri, **Rapport technique sur les opérations de pluie artificielle à Madagascar en 1953.** [Technical report on artificial rain operations in Madagascar, 1953.] *Madagascar. Service Météorologique, Publication*, No. 23, **1954.** 38 p. 14 figs., photos, 6 refs. **DWB**—During 1953, seeding begun near Lake Alaotra in 1952 was greatly augmented and the results published in 3 separate reports. This report attempts to summarize and evaluate the 1953 trials. Equipment is described, which provides NaCl particles from 10 to 75$\mu$ in diameter and disperses them into the free atmosphere (from an airplane). First trials were at Marovoay in April 1953 (7 flights), then at Mantasoa on June 17 and 18 (2 flights) and at Androy on Aug. 20 and Sept. 1 (4 flights), at Fianarantsoa on Nov. 21 and 26 (2 flights) and at Nossi-Bé on Aug. 13–18. Results are tabulated, isohyetal charts show rain occurring in area subsequent to seeding and in relation to upper winds, cloud photos are presented and conditions and results described in detail. Only a few visible showers occurred at time, but heavy rains in vicinity on next day or two are attributed to persistence of nuclei. (*Same item as* 6J–210, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with salt 2. Cloud seeding on Madagascar 3. Madagascar.**—*M.R.*

**11M–476** 551.509.617(47)

Aujeszky, László and Dési, Frigyes, **Természetes és mesterséges eső.** [Natural and artificial rain.] *Hungary. Országos Meteorológiai Intézet, Kis Népszerű Kiadványai*, No. 5, **1954.** 96 p. 32 figs. **DWB**—Although written in a popular manner, this booklet is a comprehensive review of cloud physics and artificial rainfall by authors well versed in the field. After an explanation of natural precipitation processes (synoptic situation, nuclei, dynamic development), the various forms of precipitation and the dynamics of thunderstorms are discussed. The history of weather modification is then outlined (VERAART, SCHAEFER, etc.) with details on the effects of various seeding agents (dry ice, silver iodide, water, hygroscopic substances, calcium chloride, sulphur trioxide, salt solution, etc.). Finally, the practical value and the future prospects of artificial precipitation are reviewed. The booklet includes a few details on early artificial precipitation experiments in the Soviet Union such as FEDOSEEV'S experiments in Turkmania (reported in 1931) in which rainfall was obtained by electrically charged smoke and by seeding of chemicals from airplanes; GURDON'S experiments in Tashkent (clouds were created in a clear sky by means of a gaseous substance, and rain was obtained from such clouds by an electrical method); the use of calcium chloride in the Ukraine (in the 1930's); and the conference held at the Leningrad Institute of Experimental Meteorology in 1933. The objective approach of the writers and their lucid presentation of the subject should help to clear the interested layman's mind of much of the confusion still existing in connection with the present status of weather modification. (*Same item as* 6J–211, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud physics 2. Artificial precipitation 3. History of weather control 4. Cloud seeding in U.S.S.R. 5. U.S.S.R.**—*G.T.*

**11M–477** 551.5:632.187

Barrows, J. S.; Schaefer, Vincent J. and MacCready, Paul B., Jr., **Project Skyfire. A progress report on lightning fire and atmospheric research.** In cooperation with Munitalp Foundation, Inc. *U. S. Forest Service. Intermountain Forest and Range Experiment Station, Ogden, Utah, Research Paper*, No. 35, Nov. **1954.** 49 p. 26 figs. (incl. photos.), 16 refs. **DWB**—The aim of Project Skyfire is to study the atmosphere and cloud factors influencing the occurrence, the behavior and control of lightning fires and the possibility of modifying lightning storms by cloud seeding. This report discusses the characteristics of lightning fires including their occurrence and places of origin in western forests and the relations of occurrence to elevation, the life cycle of lightning fires, early research program, the Munitalp Research Program cloud survey methods, training of cloud survey personnel, identification of jet stream with clouds, estimation of wind velocity by cloud appearance, surface winds and the jet stream, relationship between weather types and lightning, estimating of convective cloud base height from dry-bulb-wet-bulb temperatures, cloud breeding areas, measurement of atmospheric electricity and of freezing nuclei, wide angle and 3-dimensional photography and meteorological approach to reducing fire dangers. (*Same item as* 6.10–58, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Forest fire control 2. Lightning fires 3. Project Skyfire 4. Fire weather 5. Jet stream clouds 6. Thunderstorm suppression. I. Munitalp Foundation, Inc., New York.** —*I.L.D.*

**11M–478** 551.509.617:546.264

Bartnicki, L., **Sztuczny deszcz.** [Artificial rain.] *Przegląd Meteorologiczny i Hydrologiczny*, Warsaw, 7(3/4):185–187, **1954.** ref. **DLC, DWB**—A discussion of the problem of artificial rain making by seeding with crystals of carbon dioxide, or throwing small bombs containing several grams of carbon dioxide snow into cumulus clouds. The author mentions the experiments made by Langmuir and Schaefer in the U. S. in 1945, experiments made in France over La Beauce as well as Soviet studies of the problem. (*Same item as* 11.2–258, Feb. 1960, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Cloud seeding with dry ice.**—*A.M.P.*

**11M–479** 551.509.617(64)

Bidault, G. and Ousset, J., **Résultats de deux campagnes de pluie provoquée dans le secteur expérimental du Maroc Oriental.** [Results of two cloud seeding seasons in the experimental area of eastern Morocco.] *La Terre Marocaine*, Casablanca, 28(296):258–264, July **1954.** 3 tables. **DA**—Results of cloud seeding operations by means of ten AgI ground generators in eastern Morocco during the periods Feb.-June 1953 and Oct. 1953–April 1954 are tabulated and discussed. In the 1953 season (a dry period) rainfall in seeded eastern Morocco was 98% of normal while in western Morocco it was 40% of normal. In the 1953–54 season (a wet period) the figures were 146% for eastern and 115% for western Morocco. A list of seeding operations and rainfall occurrences is also given. (*Same item as* 6J-212, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in French Morocco 2. Cloud seeding with silver iodide 3. French Morocco.**—*G.T.*

**11M–480** 551.509.617

Bidault, G. and Tholy, M. P., **Les techniques d'insémination des nuages susceptibles d'augmenter le volume des précipitations.** [Cloud seeding techniques apt to increase the amount of precipitation.] *La Terre Marocaine*, Casablanca, 28(293):143 146, April **1954.** 5 photos, 2 refs. **DA**—Practical instructions for conducting cloud seeding operations by means of the most simple techniques, e.g.: 1) AgI generators burning propane, 2) ground generators burning charcoal or coke impregnated with AgI solution, 3) balloons and 4) rockets. The directions comprise all phases of the operations, including meteorological advice. (*Same item as* 6J–213, Oct. 1955, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding techniques.**—*G.T.*

**11M–481** 551.574.2

Bolton, J. G. and Qureshi, N. A., **The effects of air temperature and pressure on the decay of silver iodide.** *American Meteorological Society, Bulletin*, 35(9):395 399, Nov. **1954.** 3 figs., table, 6 refs. **DWB, DLC**—Silver iodide smoke was produced by passing an atomized stream of solution (100 gm of AgI dissolved in a solution of 25 gm of NaI in a liter of acetone) from a commercial spray gun through the flame of a kerosene lamp. The smoke was sucked into a decay box from which samples were injected into a cloud chamber that contained ice crystals. It was found that: 1) the relative number of freezing nuclei decreases with time and that the rate of decay diminishes with time, 2) the effect of air temperature on the lifetime of the freezing nuclei is extremely critical since the concentration decreases to one tenth of the initial value in four to five hours at 0°C and in a few seconds at 100°C, 3) the time for the concentration of nuclei to fall to a given value, is approximately inversely proportional to the air pressure and 4) decay rate is independent of sunlight and ultraviolet light. It is concluded that AgI released from the ground in warm climates is of slight use but may be very effective when released from aircraft or high mountains. (*Same item as* 6I-101, Sept. 1955,

*Met. Abs.*) *Subject Headings:* **1. Artificial nuclei production 2. Nuclei experiments 3. Nuclei and radiation 4. Nuclei decay 5. Silver iodide nuclei.**—*I.L.D.*

**11M–482** 551.509.617

Branston, A. J., **Rain on tap.** *Farmer's Weekly*, Bloemfontein, 87:14–15, 17, June 30, **1954.** photos. **DLC**—An enthusiastic article extolling the merits of DR. KRICK'S system of weather control. (*Same item as* 6J–214, Oct. 1955, *Met. Abs.*) *Subject Heading:* **1. Weather control.**—*G.T.*

**11M–483** 551.577.33:551.509.617(79)

Brier, G. W., **7-day periodicities in May 1952.** *American Meteorological Society, Bulletin*, 35(3):118–121, March **1954.** 4 figs., 5 refs. **DWB, DLC**—The succession of rainy weekends in the Eastern States in April and May 1952, mentioned by HAWKINS (1952), was similar to weekly periodicities in rainfall in these states and elsewhere in the U. S. in 1950 and 1951 (LANGMUIR). Analysis of such data and of 700 mb charts for the Pacific Coast region shows that there was a periodicity in occurrence of troughs or lows (at that level) to the west of Oregon or Washington, leading to the possible conclusion that the seeding activities in the Northwest were subject to a weekly periodicity because of the weekly periodicity in favorable conditions for seeding success and not vice-versa. (*Same item as* 6.2–260 and 6J-215, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding periodicities 2. Rainfall periodicities 3. Cyclone periodicities 4. Pacific Northwest, U. S. I. Hawkins, H. F., Jr. II. Langmuir, Irving.**—*M.R.*

**11M–484** 551.509.617:551.578.7(44)

Brisebois, D., **La lutte contre la grêle.** [The control of hail.] *Agriculture*, Paris, 17(157):2–4, May **1954.** figs. **DA**—Hail suppression efforts were made in the Pyrenees by M. DESSENS of Puy-de-Dôme Observatory during 50 days in 1952 and 70 days in 1953. Preliminary results are indicated and found to be not entirely discouraging. The location of the AgI ground generators (19 in 1952, 40 in 1953) is shown in charts. Charts showing the development of two hailstorms are also presented. Operations will be resumed in 1954 and 60 generators. (*Same item as* 6J 216, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Hail prevention in France 2. Cloud seeding in the Pyrenees 3. France.**—*G.T.*

**11M–485** 551.509.617(675)

Brouhns, Grégoire, **La pluie provoquée.** [Artificially induced rain.] *Belgium. Direction Générale de l'Agriculture, Bulletin Agricole du Congo Belge*, 45(3):775–780, June **1954.** refs. **DA**—Seven out of nine cloud seeding experiments made in Mayumbe, Belgian Congo, in March 1954 are reported to have produced positive results. The method used was the burning of impregnated charcoal (AgI) in mobile generators. The experiments will be continued for another season; if this is equally successful, a permanent cloud seeding operation will be set up. The effect of the seeding experiments was observed both visually and by comparison of rainfall amounts. (*Same item as* 6J–217, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Belgian Congo 2. Belgian Congo.**—*G.T.*

**11M–486** 551.509.617:634.9

Brown, A. A. (*U. S. Forest Service, Wash., D. C.*), **The significance of weather modification to a forester.** *Journal of Forestry*, 52(12):899–901, Dec. **1954. DLC**—The importance of weather modification from the point of view of forest fire control and of forest growth is discussed along with the controversial problem of the effectiveness of cloud seeding. Includes **Statement on Weather Modification** published in the *American Meteorological Society, Bulletin*, May **1953,** p. 218. (*Same item as* 6J–218, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Weather control 2. Forestry.**—*G.T.*

**11M–487** 551.577.1:551.574.1

Byers, Horace R.; Battan, Louis J. and Braham, Roscoe R., Jr., **Observations and measurements on natural and artificial rain from convective clouds.** (In: American Meteorological Society and Royal Meteorological Society, **Proceedings of the Toronto Meteorological Conference, Sept. 9–15, 1953,** pub. **1954.** p. 262–268. 5 figs., 2 tables, 9 refs.) **DWB**—Radar measurements show that in Ohio and Illinois (humid) precipitation is initiated at temperatures above ice-phase. In arid New Mexico echoes came only from cloud tops below −12°C and mostly below −24°C. If artificial nucleation requires supercooling, suitable clouds are rare in eastern U. S. Size distribution of sodium chloride particles was measured in Illinois, showing less than $1/m^3$ outsize nuclei ($>60\mu$) so that giant sea salt nuclei cannot initiate precipitation in warm clouds. (*Same item as* 6.3–256, March 1955, *Met. Abs.*) *Subject Heading:* **1. Precipitation formation.**—*C.E.P.B.*

**11M–488** 551.574.1 551.509.617

**Die Wolkenuniversität von Arizona.** [The University of Clouds in Arizona.] *Orion*, Munich, 9(21,22):854, Nov. **1954. DA**—In conjunction with the establishment of the University of Clouds

at Tucson (a joint project of the Universities of Chicago and Arizona and the U. S. Advisory Committee on Weather Control) this note reflects on the world-wide interest rainmaking is now receiving. Twenty-six nations have taken an active part in weather-modification activities so far. In the U. S., sponsorship of cloud seeding operations is shifting from farmers to water works and the water power industry. (*Same item as* 6J–219, Oct. 1955, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding research.** —*G.T.*

**11M–489** **551.509.617(45)**

Chiaraluce, Oscar, **Pioggia artificiale sulla Sila.** [Artificial rain in Sila.] *Stagioni*, Rome, 3(5):7, Jan. 31, **1954. DA**—Cloud seeding experiments by means of AgI ground generators were made in Oct. and Nov. 1953 by a team of the Italian Meteorological Service and Geophysical Institute on Scuro Mountain, Calabria, Italy. Diagrams show the orographic upslope currents carrying AgI smoke into the clouds, and reactions of clouds in various stages of development. Several instances of successful seeding are reported. (*Same item as* 6J–221, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Italy 2. Scuro Mountain, Italy.**—*G.T.*

**11M–490** **551.509.67(08)(52)**

Committee for Rain-making in Japan, Tokyo, **Report of rain-making in Japan,** vol. 1, **1954.** 159 p.+2 reprints. photos., diagrs., tables, refs. All in English. **DWB**—A nice collection of nearly a score of reports and scientific papers read at a symposium held in Tokyo in the autumn of 1953. The Committee on Rain-making in Japan was organized in the spring of 1952 by academic and government meteorologists and technicians of the electric power companies to see if some way could not be found to relieve situations such as occurred in 1951 when rainfall was so scarce all over Japan that needs for power could not be met. Rain-making experiments were begun in 1951. Since 1952 meetings of the Committee have been held twice a year to discuss results of experiments and plan future work. (For listing of papers on cloud seeding and cloud physics see 6(6):886, June 1955, *Met. Abs.*) The papers on cloud seeding are analyzed separately in the present bibliography. (Items 11M–471, –472, –515, –516, –533, –535, –550, –560 to –563 and –574.) (*Same item as* 6F 365 and 6J 222, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation symposia 2. Cloud seeding in Japan 3. Cloud physics 4. Japan.**—*M.R.*

**11M–491** **551.509.617(72)**

Compañia Mexicana de Luz y Fuerza Motriz, S. A., **Informe sobre la lluvia artificial. Año de 1954.** [Artificial rainfall report for 1954.] 7 p. 9 figs. Typewritten English translation attached. **DWB**—Cloud seeding operations were conducted in the Necaxa region, Mexico, for five summer seasons (1949 1951, 1953 and 1954). Results of the total operations are summed up and those for 1954 analyzed in detail by means of a regression analysis involving control areas. Results of the year are found to be positive for rainfall of less than 50 mm. For the five seasons normal trade wind precipitation shows positive anomaly in the seeded area; data on cyclonic rain and small rains are inconclusive. (*Same item as* 6J -223, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Mexico 2. Necaxa river, Mexico.**—*G.T.*

**11M–492** **551.509.617**

Cramer, Owen P. (*Portland, Ore.*), **A critical look at cloud seeding.** *Journal of Forestry*, Wash., D. C., 52(7):515 517, July **1954.** 15 refs. **DLC**—Four methods of cloud seeding evaluation are reviewed, namely: 1) Observed vs. normal precipitation (no control area), 2) target area vs. control area, 3) seeded storm vs. unseeded storm of similar type and 4) the modified regression method worked out by the Statistical Laboratory of the University of California. Preference is given to the last mentioned method which is more refined than the others; it involves use of long records and of control areas, and rainfall classification by synoptic type. (*Same item as* 6J–224, Oct. 1955, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding evaluation.**—*G.T.*

**11M–493** **551.509.617(213)**

Davies, D. A., **Artificial inducement of precipitation in the tropics.** *East Africa High Commission. Meteorological Dept., Technical Memorandum*, No. 6, **1954.** 11 p. 15 refs. **DWB**—A review of theory and methods used (and brief evaluation of success of these methods) to produce precipitation in the tropics by seeding with dry ice, AgI, hygroscopic substances and water. Experiments conducted in East Africa, Madagascar, Hawaii, India and Australia are considered significant, although results are not yet too definite. Further research, especially on warm cloud seeding with water, is necessary. The balloon technique used in East Africa needs further evaluation. (*Same item as* 7.9–118, Sept. 1956, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding evaluation 2. Tropical cloud seeding.**—*M.R.*

**11M–494** 551.509.617(67)

Davies, D. A., **Experiments on artificial stimulation of rain in East Africa.** *Nature*, London, 174(4423):256–258, Aug. 7, **1954.** 7 refs. **DWB**—In continuation of earlier experiments, finely ground salt carried by balloons was successfully exploded in cu cloud on 64 occasions. Of these, no rain fell on 17 (cloud often dispersed), very light rain fell but did not reach ground on 10, light rain on 30, moderate on 3 and heavy on 4. The lag between inoculation and rain was 7–35 min, average about 24 min in good agreement with 22 min expected on Bowen's theory. (*Same item as* 5.11 58 and 6J–226, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with salt 2. Balloon bomb technique 3. East Africa.**—*C.E.P.B.*

**11M–495** 551.577.59:551.590.25

Davis, Saville R., **Revolution in rain?** *Christian Science Monitor*, 46(60):9, Feb. 5, **1954.** graphs. **DLC**—E. G. Bowen's discovery of peak rainfall values on certain calendar days and his resulting meteor dust theory are discussed. Included are graphs representing long period average records of Jan. rainfall for Sydney, Auckland, Durban, Santiago, British Isles and U. S., all showing marked maxima around the same dates. Implications concerning artificial precipitation are touched upon. (*Same item as* 6J–227, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Meteoric dust effect on rainfall 2. Rainfall singularities.**—*G.T.*

**11M–496** 551.509.617

Dessens, H., **A propos d'essais de pluie provoquée dans les régions équatoriales ou tropicales.** [On experiments on artificial precipitation in equatorial and tropical regions.] *Puy-de-Dôme. Observatoire, Bulletin*, Ser. 2, No. 2:56–60, April/June **1954.** 9 refs. **DWB**—Some unpublished results of experiments on cloud seeding with sodium chloride, and with silver iodide, the efficacy of silver iodide seeding as indicated by various experiments are discussed and their inconclusiveness is pointed out. Evidence of possible successful seeding with dry ice in equatorial regions is cited. B. Vonnegut's method of silver iodide seeding is recommended for successful cloud seeding results. (*Same item as* 6J–228, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in tropics 2. Cloud seeding techniques.**—*I.L.D.*

**11M–497** 551.509.61:551.574.1:06

Dessens, H., **Comptes rendus de deux Congrès Internationaux.** [Reports on two International Conferences.] *Puy-de-Dôme. Observatoire, Bulletin*, Ser. 2, No. 3:77–85, July/Sept. **1954. DWB**—The papers concerning cloud physics and practical meteorology read at the I.U.G.G. Conference in Rome, Sept. 14–25, 1954, and at the International Colloquium on Experimental Meteorology at Zurich, Oct. 4–6, 1954 are reviewed—some of the latter in great detail. (*Same item as* 6J–229, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding research 2. Weather control 3. Conferences.**—*M.R.*

**11M–498** 551.509.617

Dessens, H. and Soulage, G., **Nouveaux essais de précipitation des nuages surfondus, hiver 1953–1954.** [New experiments on precipitation from supercooled clouds, winter 1953/54.] *Puy-de-Dôme. Observatoire, Bulletin*, Ser. 2, No. 2:43–52, April/June **1954.** 5 figs., 6 refs. **DWB**—During the winter of 1953–1954, when dense and stable stratus clouds were over the Puy-de-Dôme Observatory, wood charcoal impregnated with AgI was burned from 1600 to 2600 hours. Small crystals were precipitated. These crystals were hexagonal plates. Similar results were obtained on other occasions with stratocumulus clouds. Such clear cut results were not obtained with the use of dry-ice. Possible explanation of nucleation with AgI and observations on natural precipitations from a supercooled stratus are discussed. (*Same item as* 6.3–85 and 6J–230, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding with silver iodide.**—*I.L.D.*

**11M–499** 551.574.2

†Dessens, H., (*Puy-de-Dôme. Observatoire*), **Noyaux de condensation et pluie artificielle.** [Condensation nuclei and artificial rainfall.] *Puy-de-Dôme. Observatoire, Bulletin*, Ser. 2, No. 4:113–120, Oct.–Dec. **1954.** 2 figs., refs. p. 119–120. Additional note, *ibid.*, No. 1:16–17, Jan./March **1955. DWB**—In this paper the author reviews three recent publications and his own findings on these subjects as a summary of progress in the past 7 years (to 1954) on the relation of condensation nuclei to artificial precipitation. The first, on natural condensation nuclei (Moore and Mason, 1954), distinguishes between two types of marine air mass nuclei concentration: 1) large nuclei, when wind is strong over the sea and 2) small nuclei when wind is <7 m/s, giving a distribution similar to continental air masses. Also 2 methods of formation of nuclei: A) condensation of vapor or chemical reaction (say $NH_3HCl$), industrial protection, fires, etc. and B) by dislocation of matter by wind, etc. This leads to large nuclei ($r > 0.5\mu$), and process A to smaller ($< 0.5\mu$) nuclei. The

electron microscope permits identification down to 0.2$\mu$ but not lower. Optical methods, chemical analysis, etc. could be used for further detection of nuclei trajectories across the Atlantic shown on map illustrating time (3–4 days) air arriving in France has spent over Atlantic to explain differences between continental and marine concentration. Fragmentation operates when repeated desiccations occur (as in continental air masses) but this process, according to PACAUD (1949), is rare. KINOSITA'S (1954) are next reviewed. He has studied rate of growth of various size particles in a cloud chamber. Finally, OGIWARA'S and KOBAYASHI'S (1954) is reviewed on growth of hygroscopic NaCl nuclei in convective clouds by coalescence or by condensation. The critical size is said to be $r=23\mu$ or possibly in case of denser nuclei ($10^{-9}$ g, 1 g/m$^3$) $r=36\mu$. Finally, they conclude that seeding convective clouds with 1 to 10 nuclei per litre of $10^{-9}$ g should lead to rain formation. (*Same item as* 6F–295, June 1955, *Met. Abs.*) *Subject Headings:* **1. Condensation nuclei 2. Artificial precipitation 3. Cloud physics 4. Drop size distribution.**—*M.R.*

**11M–500** 551.509.617(714)

*Douglas, R. H., **Statistical analysis of the results of cloud seeding in Quebec, 1951 and 1952.** *Canada. Meteorological Div., Cir*-2536 Tec-193, Sept. **13, 1954.** 21 p. 18 figs., 4 tables, 11 refs. **DWB**—Cloud seeding with AgI was carried out during the fall and early winter months of 1951 and 1952 over the St. Maurice and Lake St. John-Saquenay watersheds in the province of Quebec. The resulting precipitation data are analyzed statistically by the "target-on-control regression" technique and the k-rates technique. Deficits in rainfall were found over the St. John watershed during 5 out of the 6 seeded months. Owing to evidence of abnormality in the rainfall patterns it is doubtful that these deficits were caused by seeding. The increase in precipitation during Dec. 1952 cannot be attributed to seeding. No significant effect appears to have been produced over the St. Maurice watershed. (*Same item as* 6J–231, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Quebec 2. Quebec Province, Canada.**—*I.L.D.*

**11M–501** 551.509.617:551.578.7(497.1)

Durić, Lj. **Borba protiv grada (leda, tuče).** [War against hail (ice and cumulus)]. 2d ed. Belgrade, **1954.** 20 p. 7 figs. At head of title: Državni Osiguravajući Zavod, Služba Preventivnih Mera. **DLC** (QC929.H1D75)—A small pamphlet describing and illustrating the processes of cumulus cloud and hail formation and current methods used in an attempt to prevent hail (by rockets which disperse Silver iodide in the cloud), as used in Yugoslavia (and other countries nearby). *Subject Headings:* **1. Hail prevention in Yugoslavia 2. Cloud seeding with silver iodide 3. Yugoslavia.**—*M.R.*

**11M–502** 551.509.617(969)

*Eber, L. E., Mordy, W. A. and Johnson, D. S., **Experiments in seeding clouds with hygroscopic materials.** (In Mordy, W. A. et al., **Cloud seeding project, Summary report, 1952–1953.** Honolulu, [1954?] p. 4.1–4.29. 17 figs., 3 tables, refs.) **DWB**—Seeding trials undertaken in Hawaii in 1952 and 1953 are described in detail. In these experiments nonfreezing clouds were sprayed with sea water or salt solution; the results were observed by radar. Data obtained are presented in tables and charts; radarscope photographs are included. Precipitation echoes were obtained in nine out of thirty trials. The results lead to the conclusion that "some rain can be produced from warm clouds in Hawaii by seeding with droplets of water or salt solution. The percentage of successful cases is less than reported by BOWEN for similar experiments conducted in Australia." It is suggested that this might be due to the smaller size of the clouds seeded in Hawaii. (*Same item as* 6I–107 and 6J–232, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with water 2. Cloud seeding in Hawaii 3. Radar analysis of rain 4. Rain from nonfreezing clouds 5. Hawaii.**—*C.T.*

**11M–503** 551.509.617

Elliott, Robert D. and Strickler, Robert F. (*N. American Weather Consultants, Santa Barbara Airport*), **Analysis of results of a group of cloud seeding projects in Pacific slope watershed areas.** *American Meteorological Society, Bulletin*, 35(4):171–179, April **1954.** 6 figs., 2 tables, 11 refs. **DWB, DLC**—Statistical analysis of results of cloud seeding in 3 target areas of the Far West (Central Sierras, Southern Cascades and Bitterroots of Calif., Oregon and Idaho, respectively) during 1951, 1952 and 1953, compared with simultaneous precipitation in control areas located near (but not adjacent to) the target areas and to the N and S along the same ranges, shows that excesses of precipitation (or snowpack) in the target areas averaged about 20% which is significant but not impressive, and varied from −11% to +107% during individual seasons. Poorest results are attributed to possible overseeding or seeding of control area by other projects or by chance drift of AgI from the generators over the control area. (*Same item as* 6.3–86 and 6J–233, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Western U. S. 2. Cascade Mountains, Oregon 3. Sierra Nevada Mountains, Calif. 4. Bitterroots Mountains, Idaho.**—*M.R.*

**11M–504** 551.578.7:551.509.617

Estienne, P., **La grêle et la lutte contre la grêle.** [Hail and hail control.] *Revue de Géographie Alpine*, Grenoble, 42(1):185–189, **1954. DLC**—The development of scientifically sound seeding techniques (ground-based AgI generators) has made it unjustifiable to continue with obviously worthless hail-shooting methods. But even modern cloud-seeding techniques are by no means infallible. They depend on accurate forecasting which is not easily obtained. Premature precipitation of thunderclouds may rob certain regions of vital precipitation. Author recommends legislation introducing compulsory hail insurance; this would leave more liberty of action to research scientists. (*Same item as* 6J–234, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Hail prevention 2. Cloud seeding with silver iodide.**—*G.T.*

**11M–505** 551.509.617:551.578.7(45)

Fabbri, Augusto R., **Lotta contro la grandine.** [Hail control.] *Genio Rurale*, Bologna, 17:291–293, March **1954.** 6 figs. **DA** (281.8 R522)—Application of results of American cloud seeding experiments to hail control is considered. The modification of cumuli for hail prevention does not seem possible, as shown by unsuccessful attempts made with Ruby's method, with rockets and by the Swiss hail control network. *Subject Headings:* **1. Hail prevention 2. Cloud seeding experiments 3. Italy.**—*O.T.*

**11M–506** 551.509.617(73)

Friggens, Paul, **What's happened to rain-making?** *Farm Journal*, p. 14, 93, July **1954.** diagr. **DLC**—A brief survey of current commercial rain-making operations in the United States, showing a decline in contracts with farmers, but increase in overall business owing to the interest of public utilities and cities. (*Same item as* 6J–235, Oct. 1955, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding in U. S.**—*G.T.*

**11M–507** 551.509.617(792)

Hales, J. Verne; Hoffer, Thomas E. and Peck, Eugene, **Evaluation of rain making experiments in Utah.** *Western Snow Conference, Salt Lake City, April* 1954, *Proceedings.* pub. **1954.** p. 10–18. 5 figs., 9 refs. Discussion by Boyd E. Quate, p. 16–18. **DWB**—The technique worked out at the Univ. of Utah for evaluating cloud seeding operations in Southern Utah (by Water Resources Development Corp.) is explained. "The individual percent of monthly normal maps were used in order to reduce the average orographic and local effects. . . . The entire area was divided into rectangular shaped units $\frac{1}{2}$ degree of lat. by $\frac{1}{3}$ degree of long. . . . There were 692 such small areas in the region studied. The average percent of monthly normal precipitation within each area was recorded for each month of the analysis, which included 38 unseeded winter months (Oct. April) from Jan. 1946 to March 1951 inclusive. . . . Each area average was recorded on an IBM card. . . . Thus there is a deck of 692 cards for each month."—On behalf of the operating agency, QUATE commends the authors for the objectivity of their "near-perfect" method, suggests a few details which might further improve it, and points out that this type of evaluation program requires a long period of time for conclusive results. (*Same item as* 6J–353, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding evaluation 2. Punched card analysis. I. Quate, Boyd E.**—*G.T.*

**11M–508** 551.510.721:551.515.3

Harris, D. Lee (*U. S. W. B., Wash., D. C.*), **Effects of atomic explosions on the frequency of tornadoes in the United States.** *Monthly Weather Review*, Wash., D. C., 82(12):360–369, Dec. **1954.** 12 figs., 3 tables, 5 refs. **DWB**—The increase in tornadoes reported in the United States during the past few years is ascribed to better reporting procedures rather than the presence of atomic debris. Maps showing the distribution of fallout in the United States during the first and second halves of May, 1953, are given. (*Same item as* 7E 91, May 1956, *Met. Abs.*) *Subject Headings:* **1. Atomic explosion effects on weather 2. Tornado frequencies.**—*R. J. List.*

**11M–509** 551.509.617:551.507.321.2

Henderson, T. J. (*Calif. Elec. Power Co., Bishop*), **Cloud seeder gives balloons a try.** *Electrical West*, San Francisco, 112(3):66–67, March **1954.** illus. **DLC**—The use of neoprene meteorological balloons to carry dry ice pellets to elevations of about 8500 ft by the California Electric Power Co. is described. (*Same item as* 6J-236, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding techniques 2. Neoprene balloons.**—*I.L.D.*

**11M–510** 551.509.6:34

Hollister, Paul, Jr., **Who owns the weather?** *The Freeman*, N. Y., Feb. 8, **1954.** p. 345–347. Abstracted from separated sheets. **DWB**—The past and present activities and their consequences in regard to "rain making" are reviewed from ESPY (1841) to KRICK and HOWELL in recent years.

Congressional action to decide whether rain making is feasible and what kind of legislation is neces sary (Federal, state and local) is reviewed. The Advisory Committee on Weather Control is ex pected to settle the question by June 1956. (*Same item as* 6J 237, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. U. S. Advisory Committee on Weather Control 2. Artificial precipitation 3. Weathe control legislation.**—*M.R.*

**11M–511** 551.509.617(729.1)

Howell, Wallace E., **Rainfall stimulation for hydro-electric power.** *Water Power*, London 6(1):16–21, Jan. **1954.** 9 figs. Also his: **Ours or theirs?** *Ibid.*, 6(8), Aug. **1954.** 8 p. 10 figs. 2 tables. Abstracted from reprints. **DWB**—In the first article the history of cloud seeding, benefits of increased precipitation in various economic fields and geographic locations, and requirements of a commercial weather modification program are discussed. Attractive photographs are included. In the second paper the problem of evaluation is taken up. Evaluation methods based on single storms are reviewed. A regression method involving control areas is explained in detail and illus trated by the example of seeding operations in Cuba in 1953. Operations evaluated by runoff data are also discussed. The average increase of rainfall in a number of projects at various times and places is found to be 26%. "Comparison of this average with the mean of the percentage figures (35%) shows, that, on the whole the larger percentage increases must have been associated with the smaller rainfalls." (*Same item as* 6J 238, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Artificia precipitation 2. Cloud seeding evaluation 3. Cuba.**—*G.T.*

**11M–512** 551.509.617(729.1)

†Howell, Wallace E., Associates, Inc., **Rainmaking with spray.** Cambridge, Mass. [**1954.** 11+p. 25 figs., 6 maps, refs. **DWB**—Results of rain stimulation trials made in nonfreezing clouds (Cuba, Feb. March 1954) are reported. Theoretical basis, equipment, operations and results of each individual flight, are summed up and illustrated with cloud photographs and rainfall maps. A "short bibliography relating to rainfall stimulation from non-freezing clouds" (23 refs.) is appended. The evaluation of the experiments is based on rainfall measurements on operation days in the seeded area and in surrounding areas. It is estimated that "a well-conducted operational program can approximately double the rainfall of a typical winter month and treble or quadruple the number of days in such a month when significant amounts of rain fall." In exceptionally dry years longer periods may occur when conditions do not favor seeding operations. (*Same item as* 6J–239, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Cuba 2. Cloud seeding with water 3. Rain from nonfreezing clouds 4. Cuba.**—*G.T.*

**11M–513** 551.5:061.6

**Meeting of the Atmospheric Research Committee held on 11th February, 1953, at Meteorological Office, Lodi Road, New Delhi.** *International Union of Geodesy and Geophysics, Bulletin d'Information*, 3(5):161–162, April **1954. DWB**—The Atmospheric Research Committee recommended a cloud physics unit at Poona, and a rain research unit at Delhi. Also recommended that S. K. Banerji's balloon seeding experiments be continued, and studies of infrared solar radiation (Ramdas), ozone and weather (K. R. Ramanathan), storm microseisms and sea waves (S. K. Chakravorty) and upper atmospheric potential gradient (S. P. Venkiteshwaran) be continued. (*Same item as* 6J 276, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud physics conferences 2. Artificial precipitation symposia 3. Cloud seeding research 4. Upper atmosphere research 5. Microseism research 6. New Delhi, India.**—*M.R.*

**11M–514** 551.509.617:551.501.81(969)

Johnson, David S., **Application of radar to cloud physics research in Hawaii.** (In Mordy, W. A. et al., **Cloud seeding project, Summary report, 1952–1953.** Honolulu, [**1954?**] p. 2.1–2.13. 8 figs., 15 refs.) **DWB**—Clouds and rain in Hawaii have been investigated by means of two mobile radar units supplemented with time-lapse cameras. Findings related to natural and artificial rainfall from warm clouds are summed up. In the rainfall stimulation experiments clouds were seeded from an airplane with sea water, saturated salt solutions or crystalline NaCl. A typical experiment (Feb. 21, 1953) is described, in which a cloud extending from 3000 to 7000 ft and "considered to be barely favorable for rain" was seeded with sea water. A precipitation echo was obtained 11½ min, and a shower occurred 20½ min, after spraying began. (*Same item as* 6J–240, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with water 2. Radar analysis of rain 3. Rain from nonfreezing clouds 4. Hawaii.**—*G.T.*

**11M–515** 551.509.617(52)

*§Kitamura, Kazuo, et al. (*Osaka District Central Met. Observ.*), **On the experiment of rain-making conducted at Saigo (Oki Islands) during the winter of 1952 1953.** *Committee for Rain-making in Japan, Tokyo, Report of Rain-making in Japan*, 1:97–114, **1954.** numerous figs., 5 tables. **DWB**—

This report is concerned with the effect of artificial nuclei (AgI or $Al_2O_3$). The authors apply the "variance analysis method" to precipitation in the seeded and unseeded areas having the same isohyet for a normal winter. The results are as follows: a) precipitation is increased by 3.05 mm a day in the zone where normal winter precipitation amounts to 800 mm or more, b) 2.85 mm in the 800 to 600 mm zone, c) 2.59 mm in the 600 to 400 mm zone, d) 0.72 mm in the 400 to 200 mm zone, e) the amount of increase is 2.51 mm on the average. (*Same item as* 6J–241, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Japan 2. Saigo, Oki Islands, Japan.**—*G.T.*

**11M–516** 551.509.617(524)

Kobayashi, T. and Okita, T., **General survey of studies on artificial precipitation in Hokkaido District.** *Committee for Rain-making in Japan, Tokyo, Report of Rain-making in Japan,* 1:3–7, **1954.** table, 8 refs. **DWB**—In Hokkaido district, the studies on the artificial precipitation have been carried out since Feb. 1953 by the members of the Institute of Low Temperature Science of Hokkaido University, the Asahikawa Branch of Hokkaido Gakugei University, the Sapporo District Meteorological Observatory and Asahikawa Weather Station in cooperation with the Hokkaido Electric Power Company. The principal features of the studies consisted in the following two kinds of experiments: 1) Several basic experiments on artificial precipitation were performed by seeding the natural supercooled steam fog in winter, with a view to clearing up the problems concerning the seeding technique for silver iodide and dry ice, the efficiency of silver iodide nuclei, and the growth of ice crystals under variant atmospheric conditions. 2) Applying the results of the late S. OGIWARA'S study on "the growth of water droplets around hygroscopic particles in convective cloud" we seeded the cumulus cloud with droplets of saturated sodium chloride solution by making use of ground-based generators in August 1953 in the mountainous district at Daisetsu. (*Same item as* 6J–242, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Japan 2. Hokkaido District, Japan.**—*Authors' abstract.*

**11M–517** 551.509.617

Krick, Irving P., **Progress in weather control.** *American Waterworks Association, Journal,* 46(8):803–817, Aug. **1954.** 3 tables, 4 figs., 4 refs. **DLC**—History of cloud seeding is reviewed and data presented to show the results of seeding in the Yellowstone Basin, in Spain and Portugal, and in other places in the U. S. and in Mexico or Central America. The author states that cloud seeding will not produce rain, but merely increases the amount by speeding up activity in the clouds. It also does not deprive other areas of rain since only a small portion of the possible moisture is squeezed out of the atmosphere in passing over the place in question, and an additional amount (say 2%) which would appreciably increase the economic advantages would subtract an inappreciable amount from that available elsewhere. Legal aspects and future developments are also discussed. (*Same item as* 6J–243, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Weather control 2. Cloud seeding with silver iodide.**—*M.R.*

**11M–518** 551.509.617

Krick, Irving P. and Fleming, Roscoe, **Sun, sea and sky: weather in our world and in our lives.** Philadelphia, Lippincott, **1954.** 248 p. diagrs., photos. **DLC**—In the last three chapters of the book (p. 185–243) the history and physics of cloud seeding, its value to various interests and its importance in world economy are discussed. The author underlines the merits of practical application (as opposed to pure scientific research) in advancing the cause of science in general and that of rainmaking in particular. (For fuller abstract *see item* 6.7–6 and 6J–244, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding 2. Popular meteorology.**—*G.T.*

**11M–519** 551.509.617:551.574.1:551.579(46)

Krick, Irving P., **Technical and economic aspects of weather modification in relation to water supply.** *Institution of Water Engineers, Journal,* 8(4):336–352, July **1954.** 5 figs., 2 tables. **DWB**—Cloud seeding may increase rainfall from a storm cloud by 50%. It does not interfere with the hydrologic balance, but speeds up the cycle. Statistical proof can only be obtained by prolonged operation. Physics of cloud seeding are described. Temperatures at which various nuclei become operative are set out; AgI is the most practicable. Method of operation is described. Results on winter snowfall in Colorado Rockies and annual rainfall in Rio Alberche region in Spain are favorably assessed. (*Same item as* 6.2–88 and 6J–245, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Cloud seeding in Spain 3. Rio Alberche Region, Spain.**—*C.E.P.B.*

**11M–520** 551.509.617

Krick, Irving, **Topics in address by Dr. I. Krick at Brandon, Manitoba, Canada, March 26, 1954.** *Canada. Meteorological Div., Circular* 2479, pub. 175, May 5, **1954.** 5 p. **DWB**—Comments by KRICK are extracted from his speech to farmers in S.W. Manitoba in which he: 1) denied ability to "produce rain" but merely to increase rainfall when it already occurs in an area; 2) explains ability

to prevent hail; and 3) denies possibility of "overseeding" clouds. He also claims responsibility for present-day methods of long range forecasting. Results of previous years of AgI seeding in the Brandon area are summarized and comments by ANDREW THOMSON appended. (*Same item as* 6.5–80 and 6J 246, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with silver iodide 2. Brandon, Manitoba. I. Thomson, Andrew.**—*M.R.*

**11M–521** 551.509.617:63(73)

Krick, Irving P., **Weather modification and its value to agriculture and water supply.** *Royal Society of Arts, Journal*, 102(4924):447–468, April 30, 1954. 8 figs., 8 refs. Discussion p. 465–468. **DLC**—After a brief summary of the early history of cloud seeding, the author gives a detailed survey (illustrated by many examples) of the activities of his organization. Basic principles and technical aspects of cloud seeding operations, evaluation of their results, benefits to agriculture and water works, and many other problems are discussed. A summary evaluation of 200,000 generator-hours of operation in the U. S. and six other countries is given, showing precipitation increases from 20 to 70%. A diagram showing the temperature-activity relationships of various freezing nuclei (carbon dioxide, silver iodide, loam, clay, loess, soil, sand, ash, kyanite, dust, marl, bentonite, diatoms and spore) is presented. In the discussion, problems of atmospheric moisture balance, overseeding and evaluation are taken up. (*Same item as* 6J–354, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in U. S.**—*G.T.*

**11M–522** 551.5:35 550.3:35

Landsberg, Helmut E., **Geophysics and warfare.** *U. S. Research and Development Coordinating Committee on General Sciences, CGS* 202/1 (RDB 142/1 rev.), March **1954.** 68 p. 16 figs. (photos.), 23 refs. "First version of the pamphlet prepared in 1948." **DWB, DLC** (U104.L3)—A review of recent advances in the applications of various discoveries and theories in the field of geophysics, including physics of the earth—oceanography and meteorology—to military problems and needs. The section on meteorology is concerned with the importance and application in warfare of long and short range forecasting, weather control such as the production of artificial precipitation, atmospheric electricity phenomena in aviation, upper atmosphere and atmospheric transmissions. (*Same item as* 6.7–25, July 1955, *Met. Abs.*) *Subject Headings:* **1. Military meteorology 2. Military geophysics 3. Military oceanography.**—*I.L.D.*

**11M–523** 551.509.617

Linsley, Ray K., Jr., **Artificial precipitation control.** *American Society of Civil Engineers, Proceedings*, v. 80, Separate No. 547, Nov. **1954.** 19 p. 3 figs., 2 tables, refs. **DLC**—This review of cloud physics and cloud seeding leads to the following conclusions: (1) A certain amount of rain may be induced artificially from supercooled clouds; (2) AgI is theoretically an effective nucleating agent but it is less effective than dry ice, according to experimental tests; (3) Conditions favorable to cloud seeding are the same as those required for natural rainfall; (4) Statistical studies by independent agencies have failed to show significant results of ground-based AgI seeding; (5) Hydrologic studies in target area are required for the economic evaluation of cloud seeding operations; (6) Seeding offers no relief from serious and prolonged drought; (7) State or Federal regulation of rainmaking operations is desirable and (8) Agencies should take proper precautions before employing the services of seeding companies. (*Same item as* 6J–247, Oct. 1955, *Met. Abs.*) *Subject Heading:* **1. Weather control.**—*G.T.*

**11M–524** 551.509.617

Ludlam, Frank Henry and Scorer, Robert S., **Further outlook.** London, Allan Wingate, **1954.** 174 p. 25 figs., 12 plates. **DWB, DLC**—Under the headings Weather Control (p. 120–149), Testing Rainmakers (p. 159–161) and Modern Sorcery (p. 161–163), the problems of weather modification in general and cloud seeding in particular are discussed. Modification of microclimates, air pollution control, fog dispersal, frost protection, the history of cloud modification, the various cloud seeding techniques, possible large-scale effects of seeding (LANGMUIR), problems of evaluation, etc. are taken up. Present rainmaking techniques are a product of our natural philosophy just as ancient magic was based on the philosophy of earlier times. Those obsolete methods now seem ludicrous to us and so will our methods "to a generation possessed of a far more advanced natural philosophy." (*Same item as* 6J–248, Oct. 1955, *Met. Abs.*) *Subject Heading:* **1. Weather control.**—*G.T.*

**11M–525** 551.5(09)

MacKaye, Milton, **We're cracking the secrets of weather, Pt. 1.** *Saturday Evening Post*, Philadelphia, 227(11):34–35, 80–89, Sept. 11, **1954. Pt. 2,** *Ibid.*, 227(12):36, 146–150, Sept. 18, **1954.** photos. **DLC**—The more spectacular events in the recent development of weather science

are reviewed. The highlights featured in the survey (supported by names and figures) are long range forecasting, weather modification, automatic weather stations, jet stream forecasting, the U. S. Navy's Transosonde project, ocean and Arctic weather stations, upper air research by rockets, precipitation observation and storm tracking by ground or airborne radar, the WBAN project for mechanical forecasting, etc. The photographs show meteorologists at work in their various fields of action. (*Same item as* 6.3–18, March 1955, *Met. Abs.*) *Subject Heading:* **1. Progress in meteorology.**—*G.T.*

**11M–526** 551.509.617(54)

†Mehta, Desraj and Ghosh, S. K., **Possibilities of artificial rainmaking in India.** *India. Central Board of Irrigation and Power, Annual Report (Technical)*, 2:371–380, 1952, issued **1954.** tables, 32 refs. **DWB** (626.8 I39a)—A review of methods of cloud seeding; cloud analysis with a "radiosonde" containing a string saturated with a hygroscopic salt solution; experiments in Australia, East Africa and India; seeding with balloons carrying AgI, solid $CO_2$, etc. Dangers of artificial rain and conservative opinions of scientists are offset by potential benefits and prospects. (*Same item as* 10.11–30, Nov. 1959, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Cloud seeding potentialities 3. Cloud seeding in India.**—*M.R.*

**11M–527** 551.509.617:551.578.7

Messori, A., **A che punto siamo nella difesa contro la grandine?** [Where are we in hail control?] *Il Coltivatore e Giornale Vinicolo Italiano*, Casale Monferrato, 100(4):155–156, April **1954. DA**—Brief summary of the history of hail suppression efforts. Hail shooting which was practiced with eager hopes at the beginning of this century proved inadequate. The use of explosive rockets was found to be effective in Italy but was abandoned as ineffective in Switzerland. The use of AgI smoke, recently begun in Switzerland, may be the answer to the problem. (*Same item as* 6J–249, Oct. 1955, *Met. Abs.*) *Subject Heading:* **1. Hail prevention.**—*G.T.*

**11M–528** 551.509.617

Montauti, J., **El clima artificial.** [Artificial climate.] *Revista Meteorológica*, Montevideo, 13(46):99–25, June **1954. DPU**—In connection with possibilities of weather modification, such as fog dispersal, inducement of precipitation, and hail suppression, the author discusses general knowledge on properties of clouds and on precipitation formation. He mentions evidence of successful cloud seeding with dry ice in the U. S. (1947) and Australia. (*Same item as* 6J–250, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud physics 2. Cloud seeding 3. Weather control.**—*G.T.*

**11M–529** 551.509.617

Mordy, Wendell A.; Johnson, David S. and Eber, L. E., **Cloud seeding project, Summary report, 1952–1953.** Honolulu, Territorial Cattlemen's Council [and] Pineapple Research Institute and Experiment Station [both of] Hawaii Sugar Planters' Association. [**1954?**] each section repaged. figs., refs. **DWB**—Seven papers dealing with rainfall and artificial precipitation studies in Hawaii are included in this report. These papers are the result of investigations related to the following problems: a) What are the physical properties and processes of clouds and rainfall in Hawaii? b) Can rain be induced to fall artificially? c) How can we verify that rainfall after seeding is produced by the seeding? (A radar evaluation technique has been developed.) d) How often, where and how much rain can be induced artificially? e) Can this be done economically? The papers presented are:

Mordy, W. A. and Eber, L. E., **Observations of rainfall from warm clouds.** 18 p.

Johnson, David S., **Application of radar to cloud physics research in Hawaii.** 13 p. (*See item* 11M–514)

Woodcock, A. H. and Mordy, W. A., **Salt nuclei, wind and daily rainfall in Hawaii.** 21 p. (*See item* 6I–127, Sept. 1955, *MAB.*)

Eber, L. E. et al., **Experiments in seeding clouds with hygroscopic materials.** 29 p. (*See item* 11M–502)

Mordy, W. A. and Eber, L. E., **Tentative practical estimates of rain potential from aircraft seeding.** 11 p. (*See item* 11M–530)

Eber, L. E., **Some aspects of seeding clouds from the ground.** 11 p. (*See item* 6I–108, Sept. 1955, *MAB.*)

(*Same item as* 6J–261, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Hawaii 2. Cloud seeding with water 3. Cloud seeding evaluation 4. Saline nuclei 5. Radar analysis of rain 6. Rain from nonfreezing clouds 7. Hawaii. I. Territorial Cattlemen's Council (of Hawaii) II. Pineapple Research Institute of Hawaii III. Hawaiian Sugar Planters' Association. Experiment Station.**—*G.T.*

**11M-530** 551.509.617(969)

Mordy, W. A. and Eber, L. E., **Tentative practical estimates of rain potential from aircraft seeding.** (In Mordy, W. A. et al., **Cloud seeding project, Summary Report, 1952–1953.** Honolulu [1954?], p. 5.1–5.11. 2 figs.) **DWB**—The total amount of rainfall that could be obtained by systematic seeding from aircraft over Hawaii and the cost of such operations are estimated. According to the estimate the theoretical maximum obtainable by perfect seeding operations, if no cloud would be missed and none of the droplets would evaporate on their way down, would be 48 in. a year from typical trade-wind cumulus clouds (occurring on 200 days a yr), 50 in. from thick cumuli (50 to 100 days a yr) and 63 in. from very thick clouds (25 to 50 days a yr). The cost would be (again under ideal conditions) $50,000/yr for 16 in. of rainfall over an area of 100 sq mi. (*Same item as* 6J 252, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Hawaii 2. Cloud seeding with water 3. Rain from nonfreezing clouds 4. Hawaiian Islands.**—*G.T.*

**11M-531** 551.509.617:551.578.7(494)

Müller, M. G., **Kann man Hagelschlag wirksam bekämpfen?** [Can hailfall be controlled effectively?] *Germany. Deutscher Wetterdienst, Wetterkarte*, Nos. 4, 5, 6, Jan. 4, 5, 6, **1954.** [p. 1] of each issue. **DWB**—Old-fashioned hailshooting and modern hail rocket techniques are equally ineffective because the mechanical energies available with such means are utterly inadequate if compared with those involved in hailstorms. This statement is supported by the negative results of 5 years of hail rocket experimentation in the Magadino Plain, Switzerland (1948–1952). Cloud seeding techniques might have a better chance to succeed. The author believes that funds should be made available for research on physical processes of the atmosphere instead of being used for wasteful experiments. (*Same item as* 6J-253, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Hail prevention in Switzerland 2. Weather control.**—*G.T.*

**11M-532** 551.509.617:061.3

Murgatroyd, R. J., **International Symposium on Experimental Meteorology, Zurich, October 4–6, 1954.** *Meteorological Magazine*, London, 83(990):374–375, Dec. **1954. DWB**—Organized by the Swiss Federal Commission for the Study of Hail Formation and Prevention, the symposium heard numerous papers on physics of cloud and rain, condensation and freezing nuclei, etc. These will be published in a special issue of **Archiv für Meteorologie, Geophysik und Bioklimatologie.** (*Same item as* 6.5 81, May 1955, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Condensation nuclei 3. Symposia.**—*C.E.P.B.*

**11M-533** 551.509.617:551.574.2

Naito, Hideo and Sugawara, Ken (*Nagoya Univ.*), **Determination of chemical composition of silver iodide smoke for rain-making.** *Committee for Rain-making in Japan, Tokyo, Report of Rain-making in Japan*, 1:77–81, **1954.** 4 tables, ref., 2 eqs. **DWB**—The chemical composition of silver iodide smoke emitted by a cloud-seeding generator was tested by two different techniques (Cottrell precipitator and thermal precipitation). Despite discrepancies between results obtained by the two methods the authors conclude that "more than one half and frequently more than 90% of the silver iodide is emitted into the air without decomposition." (*Same item as* 6J-254, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Silver iodide smoke generators 2. Silver iodide nuclei.**—*G.T.*

**11M-534** 551.578.41 546.212:548

Nakaya, Ukichiro, **Formation of snow crystals.** *U. S. Snow, Ice and Permafrost Research Establishment, Research Paper*, No. 3, Jan. **1954.** 12 p. 14 figs., bibliog. p. 12. **DWB**—Proposes to distinguish between ice crystals (10–300$\mu$) and snow crystals (500–4000$\mu$). The type of crystals formed depends on temperature and supersaturation. Results for natural snow crystals in this respect, according to GOLD and POWER, agree with artificial snow data by NAKAYA and HANAJIMA. A classification of ice crystals is proposed showing that the types depend on temperature in essentially the same way as the types of snow crystals. The growth of snow crystals is explained by surface diffusion of $H_2O$ molecules from minute droplets come into contact with the ice surface. Some aspects of artificial seeding are discussed. (*Same item as* 6.2–273 and 6F–328, *Met. Abs.*) *Subject Headings:* **1. Snow crystals 2. Ice crystals 3. Cloud physics 4. Cloud seeding.**—*A.A.*

**11M-535** 551.578.11 551.509.617

Ogiwara, Sekiji and Kobayashi, Teisaku (*both, Institute of Low Temperature Science, Hokkaido Univ.*), **On the growth of water droplets around hygroscopic particles in convective cloud and its application to the artificial precipitation.** *Committee for Rain-making in Japan, Tokyo, Report of Rain-making in Japan*, 1:42–45, **1954.** 4 tables, 4 figs., 9 refs., 19 eqs. Reviewed in French by M. Dessens in *Puy-de-Dôme. Observatoire, Bulletin*, Ser. 2, No. 1:16–17, Jan./March **1955. DWB**—There have hitherto been a number of careful studies (either theoretical or observational) on the

formation of rain drops in warm cloud with large hygroscopic particles as nuclei. It is generally accepted that hygroscopic particles in a convective cloud cause the condensation to occur in the initial stage and droplets thereby grown to a certain extent continue to develop by coalescence with other smaller droplets. In the present work, the degree of supersaturation in a convective cloud was first estimated with the aid of WEICKMANN and AUFM KAMPE'S observational data concerning the physical properties of cumulus clouds, and then the growth of water droplets around hygroscopic particles by condensation and coalescence was studied. It was concluded that a droplet containing more than about $10^{-10}$ g of sea salt will be able to become a rain drop in convective droplet cloud. Applying this result to the artificial precipitation, we seeded cumulus cloud with sodium chloride particles sprayed from ground-based generators. The effect of seeding was analyzed from both synoptic and statistical points of view. (*Same item as* 6J–255, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Raindrop formation 2. Artificial precipitation.**—*Authors' abstract.*

**11M–536** 551.574.2:551.509.617

Ogiwara, Sekiji and Kobayashi, Teisaku, **On the growth of water droplets around hygroscopic particles in convective cloud and its application to the artificial rainmaking.** *Low Temperature Science, Sapporo, Japan, Ser. A, Physical Sciences,* 12:94–111, **1954.** 10 figs., 5 tables, 11 refs. In Japanese; English summary p. 112. **DWB**—The degree of supersaturation in a convective cloud was estimated with the aid of WEICKMANN'S and AUFM KAMPE'S observational data on the physical characteristics of cumulus clouds and the growth of water droplets around hygroscopic particles by condensation and coalescence was studied. It is concluded that a droplet containing more than about $10^{-9}$ g of sea salt can become a raindrop in a convective droplet cloud. The effect of seeding cumulus clouds with NaCl sprayed from ground based generators is analyzed synoptically and statistically. (*Same item as* 6F–329, June 1955, *Met. Abs.*) *Subject Headings:* **1. Hygroscopic nuclei 2. Drop growth 3. Artificial precipitation.**—*I.L.D.* (*based on authors' abstract*).

**11M–537** 551.574.2:551.578.41

Ôkita, T. and Kimura, K., **Ice crystal growth in the atmosphere.** *Meteorological Society of Japan, Journal, 2nd Ser.,* 32(5/6):129–142, May/June **1954.** 11 figs., 15 photos., 2 tables, 10 refs. **DWB, DLC**—Dense steam fog in winter along rivers in Asahikawa, Hokkaido, was seeded with silver iodide nuclei by means of a new type silver iodide generator and the growth of ice crystals in the fog was observed. Various forms of ice crystals were produced, plates being predominant. A relatively small number of columns and capped columns were also found. Many stellar crystals were formed on March 14 when weather conditions were supposed to be favorable for the growth of these crystals. The observed sizes showed good agreement with the value predicted by HOUGHTON within about 150 m from the generator, but at larger distances the size became smaller than predicted. This probably suggests that larger crystals had fallen upon the ground through the shallow fog layer before they were carried to distant places. (*Same item as* 6J–256, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with silver iodide 2. Ice crystal growth 3. Fog effects 4. Japan.** —*Authors' abstract.*

**11M–538** 551.509.617:06:045

Orville, Howard T., **Aims and activities of the U. S. Advisory Committee on Weather Control.** *Western Snow Conference, Salt Lake City, April 1954, Proceedings,* pub. **1954.** p. 1–4. Discussion by Robert D. Elliott, p. 2–4. **DWB**—The policy governing the Advisory Committee's activities and the type of information the Committee is seeking to obtain are outlined. ELLIOTT, speaking for North American Weather Consultants, and rainmaking operators in general, mentions some of the results achieved in cloud seeding, welcomes the unbiased attitude taken by the Advisory Committee, and asserts the necessity for a more rigid legislation to protect from unqualified operators. (*Same item as* 6J–355, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. U. S. Advisory Committee on Weather Control. I. Elliott, Robert D.**—*G.T.*

**11M–539** 551.509.617:06:045

Orville, Howard T. (*Bendix Aviation Corp., Baltimore*), **Present status of weather modification.** *New York Academy of Sciences, Transactions,* Ser. 2, 17(1):45–51, Nov. **1954.** 6 refs. **DLC**—History of attempts at cloud seeding from 1930 (VERAART) to date, and aims of the U. S. Advisory Committee on Weather Control are reviewed. Several projects already carried out by the Advisory Committee, and categories into which types of activity or information are divided (acceptable, doubtful and very doubtful information) are outlined. Economic value of report to be submitted in 1956 by the Committee, regardless of whether positive or negative, is suggested. (*Same item as* 6J–257, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding 2. U. S. Advisory Committee on Weather Control.**—*M.R.*

**11M–540** 551.509.617

Orville, Howard T. (*Chairman, U. S. Advisory Comm. on Weather Control*), **Weather made to order?** *Colliers*, N. Y., 133(11):25–29, May 28, **1954.** illus. (col.), photos, port. **DLC**—A report on the possibilities of controlling weather for civilian or military purposes by means of cloud seeding techniques developed since 1946, and on the more accurate and specific weather forecasts which may be expected in 10 years if a stepped-up observation and instrumentation program for a close network of stations were carried out. If several billion dollars were spent on research in weather control over 40 years, it might be possible to control drought, hail, thunderstorms, tornadoes, floods, snow, fog, clouds, etc. (*Same item as* 6.2–89 and 6J–258, *Met. Abs.*) *Subject Headings:* **1. Weather control 2. Cloud seeding.**—*M.R.*

**11M–541** 551.509.617

Pavelis, George A. (*Mont. State Coll., Bozeman*), **Economic and social aspects of weather control.** *Montana Academy of Sciences, Missoula, Proceedings*, 14:45–47, **1954.** 5 refs. **DA**—Author calls for a clear understanding of the limitations of cloud seeding, for better coordination between groups sponsoring weather modification operations, and for information to be made available to an "impartial group evaluating experimental or commercial operations." (*Same item as* 6J–259, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Weather control 2. Cloud seeding evaluation.**—*G.T.*

**11M–542** 551.577.11

Pavie, Ch., **La création de nuages pluvigènes.** [Formation of rain clouds.] *Almanach Agricole Tunisien*, Tunis, **1954.** p. 409–422. **DA**—General discussion of the natural formation of rain clouds. By trying to preserve and build up water resources in arid regions instead of depleting them a natural equilibrium of the elements required for precipitation formation could be achieved. (*Same item as* 6J–260, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Precipitation formation 2. Atmospheric water balance.**—*G.T.*

**11M–543** 551.509.617(675)

*Pire, J. J., **Essais de pluies artificielles à Temvo, Congo Belge en mars 1954.** [Artificial rain at Temvo, Belgian Congo, March 1954.] *Académie Royale des Sciences Coloniales, Bulletin des Séances*, 25(5):1560–1575, **1954.** fig., tables (91 fold.), 7 refs. **DLC**—Results of AgI seeding tests in the Temvo region of the Belgian Congo at 8 experimental and 22 control stations (upwind from generators) on 7 experimental and 22 control days in March 1954 are presented in detailed tabular form and analyzed statistically for significance of tests. Although less rain fell on the experimental than on the control days, it was concluded that the results of the seeding were too high to occur by chance at the .001 confidence level, and that the rainfall at the 8 experimental gages was more than that at the 22 test stations so as to be beyond the .01 confidence limit. This apparent anomaly is due to the fact that the seeding days were generally less rainy than the control days. (*Same item as* 6J–261, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Belgian Congo 2. Temvo Belgian Congo.**—*M.R.*

**11M–544** 551.509.617(899)

Piriz, Nestor A., **Lluvia artificial en el Uruguay.** [Artificial rain in Uruguay.] *Revista Orientación Meteorológica*, Montevideo, No. 7:33–34, June **1954.** **DWB**—Rainmaking experiments in Uruguay are conducted with a novel technique described in this article. The technique is based on the fact that if the electron equilibrium in a cloud is disturbed, a sudden growth of the cloud droplets by coalescence may ensue. Since clouds have a negative charge, the introduction of a positive field will lead to the desired effect. This is achieved by means of ionized aluminum powder exploded in the cloud. On April 10, 1954 rain was produced from a stratocumulus (showing little promise of rain) over an area several km in diameter. This experiment was carried out before a selected audience comprising public figures and representatives of press and radio. (*Same item as* 6.6–137 and 6J–262, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with ionized aluminum 2. Uruguay.**—*G.T.*

**11M–545** 551.575.1:551.509.615

Plank, Vernon G., **Fog modification by cold-water seeding.** *U. S. Air Force. Cambridge Research Center, Geophysical Research Papers*, No. 31, Aug. **1954.** 21 p. 6 figs., 3 tables, 9 refs. **DWB, DLC**—Heat and mass transfer processes associated with the passage of a cold drop through a volume of fog are reviewed. The role of the thermal relaxation mechanism is pointed out and thermal relaxation times for 100$\mu$ and 1000$\mu$ drops are computed for saturated and foggy conditions. Diffusion and coalescent growth processes are described and the equations of these processes are utilized in conjunction with thermal relaxation curves to compute the mass acquired by 100$\mu$ and 1000$\mu$ drops at 0°C falling through 20 m of 10°C fog. The recondensation process, the effectiveness of the coalescence mechanism in improving fog visibilities and the probability of using B-29 tanker aircraft for

water seeding operations are discussed. A table showing the probable visibility improvements resulting from maximum seeding concentration is presented. (*Same item as* 6J–263, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Artificial fog dissipation 2. Cloud seeding with water.**—*Based on author's abstract.*

**11M–546** 551.578.7:551.509.617

Quate, Boyd E. (*Water Resources Development Corp.*), **Cloud seeding and its application to hail suppression.** *Idaho State Horticultural Society, Transactions*, p. 38–41, **1954.** Mimeo. **DA**—The principles of hail suppression by overseeding with silver iodide, as practiced by Water Resources Development Corporation under I. P. KRICK, are explained. The author concludes by stating that while "it does not seem feasible as of this date to completely eliminate hail, there is positive evidence that the maximum size to which hail stones would normally grow can be reduced with a considerable reduction in the maximum damage that would result." (*Same item as* 6J–264, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Hail prevention 2. Overseeding.**—*G.T.*

**11M–547** 551.577.2(54)

*Rai Sircar, N. C. and Hariharan, P. S. (*Met. Off., Poona*), **The density of reporting network necessary for proper appraisal of the occurrence of rainfall in small areas in different localities in India in various seasons.** *Indian Journal of Meteorology and Geophysics*, Delhi, 5(3):219–229, July **1954.** 20 figs., 4 tables, 2 refs. **DWB, DLC**—A study has been made of the minimum density of network of rain gage stations necessary for a proper appraisal of the character of rainfall in a given small area. Apart from the statistical value of the results obtained, this study has thrown some useful light in regard to our criteria for the assessment of rainfall forecasts for small areas such as those included in the Farmers' Weather Bulletins. Some of the findings of the study are of particular interest. For example, while one would conclude, on the basis of data of Calcutta alone, that the liability of the area around the station to get rain of 10 cm or more during the premonsoon season is only 11 for every 100 days, the analysis based on data of all rain gage stations within 50 miles around Calcutta shows that on as many as 53 per cent days one or more stations in that area is likely to have rain of 10 cm. or more. Similar findings, as have been obtained for other areas and in other seasons, are of value in connection with the districtwise forecasts that are being issued for the use of farmers. (*Same item as* 6J–266, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Rainfall networks 2. Rainfall normals 3. Rainfall evaluation 4. India.**—*Authors' abstract.*

**11M–548** 551.577.11

Roulleau, J., **La formation de la pluie.** [Rain formation.] *La Météorologie*, Paris, 4th Ser., No. 35:221–230, July/Sept. **1954.** 11 figs., table, eq. French, English and Italian summaries p. 221. **DWB**—A technical review of theories and knowledge of cloud physics, natural rain or hail formation and artificial triggering of precipitation beginning with the BERGERON theory in 1933 and revised by virtue of recent studies of coalescence, and other methods of drop accretion. Radar studies are also described and illustrated. (*Same item as* 6J–268, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Precipitation formation 2. Radar analysis of rain 3. Artificial precipitation.**—*M.R.*

**11M–549** 551.509.617

Roulleau, J., **La pluie artificielle.** [Artificial rain.] *La Houille Blanche*, Grenoble, 9(1):38–42, Jan./Feb. **1954.** English summary p. 38. Digest and discussion. *Ibid.*, Special No. B, 8:698–700, Nov. **1953. DLC**—In this general treatment of the problem of rainmaking, the natural mechanism of rain, the effect of cloud seeding and the usefulness of rainmaking are discussed. While emphasizing the utility of cloud seeding in various situations the author nevertheless makes it clear that it does not appear to be possible so far to modify precipitation of large cloud systems connected with major perturbations. The effectiveness of cloud seeding is limited to shower clouds. (*Same item as* 6.1–111 and 6J–269, *Met. Abs.*) *Subject Heading:* **1. Artificial precipitation.**—*G.T.*

**11M–550** 551.509.617(522)

Sakanoue, Tsutomu (*Kyushu Univ.*), **Outline of the research of rainmaking in Kyushu district.** *Committee for Rain-making in Japan, Tokyo, Report of Rain-making in Japan*, 1:28–30, **1954.** Also: Takeda, Kyoichi and Sakanoue, T., **Research on rain-making in Kyushu area.** *Ibid.*, p. 115–140. 19 figs., table, 5 refs., 2 eqs. **DWB**—Detailed description of method and equipment used in cloud seeding experiments in Kyushu (1952–1953). In these experiments dry ice or AgI was released from balloons. Results were evaluated with the help of surface and upper air charts, rawin observations and a dense raingage network. The ascents are discussed individually and some of them found to have shown significant results. (*Same item as* 6J–270, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Japan 2. Kyushu, Japan.**—*G.T.*

**11M–551** 551.574.2

Schaefer, Vincent J., **Silver and lead iodides as ice-crystal nuclei.** *Journal of Meteorology* 11(5):417–419, Oct. **1954.** 3 figs., 5 refs. **DWB**—Cloud chamber comparisons showed that both iodides are equally effective as sublimation nuclei below −5°C. As condensation nuclei at +5°C both were effective, but droplets formed on silver iodide froze at −5°C, those on lead iodide not till −20°C. Difference is attributed to much lower solubility of AgI. (*Same item as* 6.3-236, March 1955, *Met. Abs.*) *Subject Headings:* **1. Condensation nuclei 2. Freezing nuclei.**—*C.E.P.B.*

**11M–552** 551.574.1:551.509.617

Serpolay, R., **Action de certains liquides frigorigènes sur les nuages surfondus.** [Effect of certain cold-producing liquids on supercooled clouds.] *Puy-de-Dôme. Observatoire, Bulletin*, Ser. 2, No. 4:99–102, Oct./Dec. **1954.** 3 figs. **DWB**—Some cold-producing liquids, like dichlorofluoromethane (b.p. −30°C) and methyl chloride (b.p. −24°C), give rapidly a very large number of ice crystals when they are sprayed in supercooled clouds just below 0°C. The earliest experiments (1953) have been conducted on artificial clouds produced in close atmosphere (home freezer or refrigerating room). Some field experiments recently extended the results obtained in laboratory to the natural supercooled fogs or stratus. (*Same item as* 6F 340, June 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding 2. Ice crystal formation.**—*Author's abstract.*

**11M–553** 551.509.617(65)

Serpolay, R., **Résultats des essais de modification des précipitations effectués en Algérie pendant la campagne 1951–1952.** [Results of rainfall modification experiments carried out in Algeria during the 1951–1952 season.] *Puy-de-Dôme. Observatoire, Bulletin*, Ser. 2, No. 1:27–31, Jan. **1953.** fig., 4 refs. Also his: **Essais de modification . . . 1952 1953.** *Ibid.*, No. 1:6–15, Jan./March **1954.** 5 figs., 9 refs. Also his: **Essais de modification . . . 1953–1954.** *Ibid.*, No. 4:109–112, Oct./Dec. **1954.** fig., 2 refs. **DWB**—First article: silver iodide generators were placed on a line running NNE-SSW, perpendicular to the prevailing wind direction through Algiers. From 28 Dec. 1951 to 30 April 1952, 13 experiments were carried out. Three experiments leading to rainfall had a possible relationship to AgI seeding; six attempts had a dubious relationship; and in four, the results were independent of the seeding. Second article: between Sept. 1952 and April 1953 63,275 kg of AgI were employed during 104 days to seed cumuliform clouds. On 13 (or 50%) of the attempts very heavy rainfall occurred near and in the lee of generators, as compared with the control area. A comparison of the rainfall distribution and amount during the experimental period with a 12-year normal for this period indicates a definite increase in rainfall during 1952–53 as compared with the normal. The rainfall distribution and deviations are shown on maps. Third article: in 1953–54 seeding was conducted on 84 days. Two large charts show departure of Sept.–April 1953–54 rainfall over 1939–1951, with area of positive anomaly centered in all directions around the line of seeding, and another showing corrected anomalies (leaving out snow days in Feb. and days with cloudburst in April) with area of positive anomaly extending far to the east and not at all to the west of the line of seeding, indicating a slight (+14%) amount of effectiveness downwind, ranging from 2% to 38%. (*Same item as* 6J–271, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Algeria 2. Algeria.**—*I.L.D., M.R.*

**11M–554** 551.509.617:551.551.8

Serra, Louis, **Diffusion dans l'atmosphère des noyaux d'iodure d'argent.** [Atmospheric diffusion of silver iodide nuclei.] *Puy-de-Dôme. Observatoire, Bulletin*, Ser. 2, No. 3:65–76, July/Sept. **1954.** diagrs., table. **DWB**—In order to control properly the number of AgI nuclei which will be introduced into a given cloud or portion thereof it is necessary to accurately calculate the temperature gradient effects, the lines of equal concentration (theoretical and actual), the effect of several generators, and the effect of horizontal and vertical air movements around or over hills and other topographic features. Some of these problems are worked out theoretically and with a view to determine the order of magnitude of these factors. (*Same item as* 6I–119, September, 1955, *Met. Abs.*) *Subject Headings:* **1. Silver iodide nuclei 2. Nuclei diffusion 3. Cloud seeding 4. Nuclei theories.**—*M.R.*

**11M–555** 551.509.617(783)

Sinclair, Gerald, **South Dakota rain increase analysis—five areas, 1953. Supplemented by rain increase analysis by specific months for 1951, 1952, 1953.** Brookings, South Dakota State College, [1954?]. 17 p. figs., tables. **DWB**—During the summer of 1953 cloud seeding in South Dakota affected 5 areas for periods of varying length. This report sums up the results of an evaluation of data supplied by the Water Resources Development Corp. The evaluation method used includes the "percentage of normal" and a formula derived from a regression method. Results indicate an overall average 16% increase in precipitation. In a supplementary table an example is shown of cloud seeding evaluation on the basis of selected months (with large number of seeding

opportunities), and choice of target and control area along the same storm path. (*Same item as* 6J–272, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding evaluation 2. Cloud seeding in South Dakota 3. South Dakota.**—*G.T.*

**11M–556** 551.509.617

Sincock, Robert L., **Test plots for cloud seeding.** *Oregon Farmer*, Portland, 77(15):6–7, Aug. 5, **1954.** photo. **DA**—Describes rain prevention operations sponsored by Yakima Valley, Wash., cherry growers and conducted by meteorologist JACK HUBBARD. Rain prevention efforts are being made while rainmaking operations are going on in nearby Horse Heaven Hills. HUBBARD'S project was started experimentally in 1951 and has been pursued commercially since 1952. Qualitative results are indicated. The seeding technique involves burning of two unidentified fume-yielding chemicals. Their effect is not believed to be based on overseeding but possibly something resembling catalytic action. (*Same item as* 6J–273, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Artificial cloud dispersal 2. Rain prevention.**—*G.T.*

**11M–557** 551.508.91:551.507.352:551.574.1:551.509.617

Smith, E. J. and Heffernan, K. J., **Airborne measurements of the concentration of natural and artificial freezing nuclei.** *Royal Meteorological Society, Quarterly Journal*, 80(344):182–197, April **1954.** 10 figs., 5 tables, 11 refs. **DWB, DLC**—An apparatus for observation of freezing nuclei by aircraft is described. Number of ice crystals estimated visually was recorded as a function of temperature and converted to concentration of freezing nuclei by an experimental factor obtained with silver iodide smoke. Observations of natural freezing nuclei on 31 flights near Sydney, Australia, are analyzed. Temperature of complete glaciation was $-35\frac{1}{2}\pm1$°C, highest temperature for 1 crystal/liter was around $-20$ to $-24$°C. Concentration of nuclei around a silver iodide generator on the ground was plotted up to 1200 m height. (*Same item as* 5.9–10, Sept. 1954, *Met. Abs.*) *Subject Headings:* **1. Nuclei counters 2. Cloud seeding 3. Condensation nuclei.**—*C.E.P.B.*

**11M–558** 551.509.68:662.2:539

Steinhauser, Ferdinand, **Atomenergie und Weltwetter.** [Atomic energy and world weather.] *Universum*, Vienna, 9(16):481–488, Aug. 2, **1954.** 3 figs., cover photo. Also his: **Atombombenexplosionen und Wettergeschehen.** [Atom bomb explosions and weather phenomena.] *Universitas*, Stuttgart, 9(11):1189–1196, Nov. **1954.** Abstracted from reprint. **DWB**—Atomic blasts will not affect large-scale weather development. This is supported by general data showing that: 1) the order of magnitude of energy released in thermonuclear explosions is insignificant compared with that involved in large-scale atmospheric processes, 2) the energy supply from explosions is instantaneous and therefore cannot influence a continuous process like weather development, 3) the world-wide rainfall amount cannot be permanently increased by a supply of condensation nuclei (supposedly provided by atomic explosions) because (a) there are usually enough condensation nuclei present in the atmosphere, (b) the mere presence of sufficient condensation nuclei does not produce precipitation and (c) increased precipitation would have to be balanced by increased evaporation; which is not done by atomic explosions. As to planned weather modification, the author believes that this could be achieved by slow rather than explosive release of thermonuclear energy. He leaves open the question whether such a weather modification plan would be practical and desirable. (*Same item as* 6.7–178, July 1955, *Met. Abs.*) *Subject Headings:* **1. Atomic explosion effects on weather 2. Grosswetterlagen 3. Condensation nuclei.**—*G.T.*

**11M–559** 551.509.617

Street, A. G., **Must they make more rain?** *Farmers Weekly*, London, 41(21):75, Nov. 19, **1954.** Photo. **DA**—In this discussion of current problems in farming, the author takes up, among other topics, the news of rain making experiments to be carried out on Salisbury Plain in the spring of 1955. He suggests with rustic directness that scientists stop meddling with the weather. (*Same item as* 6J–274, Oct. 1955, *Met. Abs.*) *Subject Heading:* **1. Artificial precipitation.**—*G.T.*

**11M–560** 551.509.617(52)

Sugawara, Ken and Sano, Isamu (*Nagoya Univ.*), **A brief account of the cloud stimulation research in Chubu district.** *Committee for Rain-making in Japan, Tokyo, Report of Rain-making in Japan*, 1:17–23, **1954.** 3 figs., table, 3 refs., 2 eqs. **DWB**—A research program on cloud seeding was started in Chubu District, Japan, in July 1952 with the co-operation of Chubu Electric Power Co., Nagoya University and Nagoya Local Meteorological Observatory. In this report the following phases of the program are discussed, 1) construction of the smoke generators (a light oil-combustion type and a propane combustion type AgI smoke generator), 2) analysis of the purity of AgI smoke, 3) investigation of the atmospheric diffusion of AgI smoke and 4) formation of snow along the path of AgI smoke in a field experiment at Takayama, Gifu Prefecture. (*Same item as* 6J–275, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Japan 2. Chubu District, Japan.**—*G.T.*

**11M–561** 551.509.617(52)

Takahashi, Yoshihiko (*Met. Res. Inst., Tokyo*), **Artificial rain-making in Kanto district.** *Committee for Rain-making in Japan, Tokyo, Report of Rain-making in Japan*, 1:15–16, **1954.** 9 refs. **DWB**—Brief general account of cloud seeding experiments and laboratory studies conducted in 1952 under the sponsorship of Tokyo Electric Power Company. A list of 9 papers reporting results of the program is added. (*Same item as* 6J–277, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Japan 2. Kanto District, Japan.**—*G.T.*

**11M–562** 551.509.617(52)

Takahashi, Yoshihiko (*Met. Res. Inst., Tokyo*), **On the cloud seeding experiments in Kanto and Chubu districts in the summer of 1952.** *Committee for Rain-making in Japan, Tokyo, Report of Rain-making in Japan*, 1:69–76, **1954.** Also in: *Papers in Meteorology and Geophysics*, Tokyo, 5(2):165–172, Sept. **1954.** 11 figs., 6 refs. **DWB**—Two large scale experiments on cloud seeding were made in the summer of 1952 following the present author's suggestion that silver iodide smoke should be released in less turbulent wind at a high level by the seeding operation on the top of a high mountain. In the experiment of Tokyo Electric Power Company charcoal burners of silver iodide were employed, and in the experiment of Chubu Electric Power Company the improved light oil furnace type smoke generators after the present author's design were employed. The seedings were more or less effective in many cases. Two excellent results are illustrated. The lateral and vertical spreading of silver iodide smoke by turbulent diffusion in the air was made known to some extent from the results of the experiments. (*Same item as* 6J–278, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Japan 2. Japan.**—*Author's abstract.*

**11M–563** 551.509.617(52)

*Takahashi, Yoshihiko (*Met. Res. Inst., Tokyo*), **Record of cloud seeding in Japan, 1947–1954.** *Committee for Rain-making in Japan, Tokyo, Report of Rain-making in Japan*, 1:31–41, **1954.** Entirely tables. **DWB**—Sums up information on cloud seeding experiments conducted under the sponsorship and with the participation of the electric power companies of Hokkaido, Tohoku, Tokyo, Chubu, Kansai and Kyushu. With the exception of a single inconclusive experiment in Kyushu (Nov. 1947) the experiments were made in 1951–1954. Details of 28 seeding operations ranging in duration from one day to three months, are described. The information tabulated comprises the following items: 1) Date, 2) Personnel, 3) Method and equipment, 4) Place, weather and cloud conditions, 5) Details of operation and 6) Results (mostly qualitative). Several instances of precipitation in seeded areas far in excess of control areas are reported. (*Same item as* 6J–279, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Japan 2. Japan.**—*G.T.*

**11M–564** 551.509.617

Taylor, Frank J., **They make rain when the clouds roll by.** *Readers Digest*, Pleasantville, N. Y., 65(388):135–138, Aug. **1954. DLC**—World wide services in attempts at artificial rainmaking (weather modification) by IRVING KRICK and his Water Resources Development Corp., which in 4 years has grown into a million-dollar business, are summarized in this condensation of an article in *Prairie Schooner*, (Univ. of Nebraska Press), for Summer **1954.** Cloud seeding projects using silver iodide carried out in Spain in 1952–3, in the Horse Heaven Hills of Washington in 1950, and in the Dallas-Fort Worth area in 1952–53, are described and the success evaluated. (*Same item as* 6J–280, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Spain 2. Cloud seeding in U. S. 3. Spain 4. Texas 5. Horse Heaven Hills, Wash.**—*M.R.*

**11M–565** 551.509.617

Tindall, Cordell, **Will cloud seeding bring more rain?** *Missouri Ruralist*, p. 6, 38–39, Feb. 13, **1954.** fig., photos. **DLC**—Discusses planned cloud seeding project to be sponsored by a pool of farmers over a territory comprising several counties in Missouri. The program would be carried out by the Weather Corporation of America headed by W. HARTNETT. Missouri College of Agriculture plans to evaluate results of the seeding operations. Scientific, financial and legal aspects of rainmaking are discussed. (*Same item as* 6J–281, Oct. 1955, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding projects.**—*G.T.*

**11M–566** 551.509.617

Tominaga, Hitoshi and Kinumaki, Susumu, **Note on a method of spraying AgI-in-liq. $NH_3$ solution for the purpose of the artificial seeding.** *Tohoku University, Science Reports, 5th Ser., Geophysics*, 6(1):39–42, Aug. **1954.** 8 figs., 2 tables, 3 refs. **DWB, DLC**—AgI is very soluble in liquid $NH_3$. Hence apparatus was devised to spray such a solution into clouds instead of using charcoal smoke or hydrogen flames. Device is illustrated schematically and photographically, and particles shown in electronmicroscope photographs enlarged 7500 and 15,000 times. Distribution

of particle size shown to be predominantly <100 Å. Data on surface tension, vapor density, etc. are tabulated. Corrosion of containers or metal parts by solution was found to be negligible after 10 minutes. Method seems as good as VONNEGUT'S. (*Same item as* 6J–282, Oct. 1955, *Met. Abs.*) *Subject Heading:* **1. Silver iodide smoke generators.**—*M.R.*

**11M–567** 551.509.617

United Nations. Dept. of Public Information, **Rainmaking: a study of experiments.** *United Nations, Publications,* [unnumbered], Jan. 22, **1954.** 18 p. photos. Also in: *United Nations Review,* N. Y., 1(1):18–25, July **1954. DWB**—A general survey of successes and failures in rainmaking in various parts of the world—notably Tanganyika in 1951/52 (AgI exploded into cloud with gunpowder by means of hydrogen balloons), India (1952) where in 1948–51 90% of cloud tops were below freezing level (7285 aircraft reports), Australia, Argentina, Peru, Pakistan (salt on ground or from airplanes—1953), U. S. and Central America. Claims to limited success in some cases are stated with reservation, but need for more extensive tests and careful evaluation expressed in strong terms. (*Same item as* 6J–283, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Cloud seeding techniques. I. World Meteorological Organization.**—*M.R.*

**11M–568** 551.509.617

U. S. Congress. House. Committee on Appropriations, **Third supplemental appropriation bill, 1954. Hearing before subcommittees, 83rd Congress, Second Session.** Wash., D. C., Govt. Print. Off., **1954. DLC**—P. 182–194 treat requested budget for the Advisory Committee on Weather Control. H. T. ORVILLE, chairman of the Advisory Committee answers questions on the scope of work contemplated by his Committee for the next 2 years, and gives an outline of proposed expenditures and justification for various items in his budget (proposed staff, travel, etc). The initial work by a small staff of experts, working with the Advisory Committee, will be to collect reports and data on cloud seeding activities in the U. S. and possibly abroad and to evaluate the effectiveness of these efforts (both beneficial and detrimental) with a view toward recommending Federal legislation to control such activities if found necessary. (*Same item as* 6.6–139 and 6J–284, *Met. Abs.*) *Subject Headings:* **1. U. S. Advisory Committee on Weather Control 2. Cloud seeding evaluation 3. Weather control budget. I. Orville, H. T.**—*M.R.*

**11M–569** 551.509.617(73)

U. S. Congress. Senate. Committee on Appropriations, **Third supplemental appropriation bill, 1954. Hearings before the Committee, 83rd Congress, Second Session, on H.R. 4841.** Wash., D. C., Govt. Print. Off., **1954. DLC**—P. 60–69 treat requested budget for the Advisory Committee on Weather Control. The presentation contains a statement of the program of the Committee; a description of planned composition of its staff; a statement by the Department of Agriculture on the importance of weather modification, in particular artificial rainfall to agriculture; a brief statement on the extent of cloud seeding operations carried on in the U. S. and abroad and short biographical sketches of the private and public members of the Committee. (*Same item as* 6.5–83 and 6J–285, *Met. Abs.*) *Subject Headings:* **1. U. S. Advisory Committee on Weather Control 2. Weather control budget 3. Cloud seeding in the United States 4. Biography.**—*I.L.D.*

**11M–570** 551.576.1:551.509.616

Vaillant, J., **Est-il possible de provoquer des ascendances génératrices de cumulus de convection thermique?** [Is it possible to create updrafts which will produce convective cumulus?] *Puy-de-Dôme. Observatoire, Bulletin,* Ser. 2, No. 4:103–107, Oct.–Dec. **1954.** fig. **DWB**—Suggested means of inducing artificial convective clouds where no clouds exist, by superheating small areas with the aid of solar energy. An experimental area of 200 to 500 ha for thermal convection studies is proposed for Algeria using large areas of shallow water (0.3 to 0.8 m depth) with island in the middle which would be relatively hot. (*Same item as* 6J–286, Oct. 1955, *Met. Abs.*) *Subject Heading:* **1. Artificial convective cloud generation.**—*M.R.*

**11M–571** 551.509.6:551.542.1

Weiller, A. R., **Les tempêtes artificielles sont-elles pour demain?** [Will artificial gales be produced tomorrow?] *La Météorologie,* 4th Ser., No. 34:127–136, April/June **1954.** 12 figs., ref., 23 eqs. English and Spanish summaries p. 127. **DWB**—In this theoretical analysis of the dynamics of gradient winds, it is shown how strong winds might be induced in certain synoptic situations by sudden changes in the pressure gradient. Such changes could be caused by atomic explosions. Without going into the technical or economical feasibility of such an enterprise, the author merely suggests that nuclear explosions might be more effectively used in weather modification than present cloud seeding practices. After the thermonuclear explosion on Eniwetok in March 1954 radioactive fallout was reported in unexpected areas; the explosion was found to be twice as powerful as antici-

pated. These facts indicate that the baric field may have been disturbed and strong winds produced. (*Same item as* 6.8–256 and 6J–287, *Met. Abs.*) *Subject Headings:* **1. Weather control 2. Artificial winds 3. Gradient winds 4. Atomic explosions.**—*G.T.*

**11M 572** 551.509.617:632.187

Wetterer, Charles S. (*W. E. Howell Assoc., Inc., Cambridge, Mass.*), **Rainfall stimulation for forest fire prevention and control.** *Pulp and Paper Magazine of Canada*, Montreal, 55(7):166–173, June **1954. DA, DLC**—In this talk presented at a Woodlands Section Annual Meeting in Montreal, the author begins with the historical and physical background of rainmaking. He then discusses the role of sponsoring agencies and of professional "rainmakers" in organizing cloud seeding projects. Finally, he shows applications of cloud seeding not only to lowering forest fire danger but to combating actual forest fires. An example of a successful achievement of this latter purpose is given. (*Same item as* 6J–288, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding 2. Forest fire control.** —*G.T.*

**11M–573** 551.509.617

†World Meteorological Organization, **Artificial inducement of precipitation with special reference to the arid and semi-arid regions of the world.** Its *Technical Note*, No. 1, *WMO Publication* No. 24 TP 7, **1954.** 24 p. 87 refs. Review by O. M. Ashford, **Artificial control of clouds and hydrometeors,** in *World Meteorological Organization, WMO Bulletin*, 5(1):28–31, Jan. **1956. DWB**—This review of world-wide weather modification efforts is based on replies received to a preliminary inquiry made by the WMO Secretariat. It includes: 1) a brief critical study of results achieved by the various projects, 2) a general analysis of atmospheric conditions favoring rainmaking experiments in various countries, 3) a survey and tentative evaluation of current techniques and 4) a list of references arranged by continents. It is found that (a) operations hitherto carried out proved inconclusive, (b) regions and seasons favoring natural precipitation are also most favorable for artificial inducement of precipitation and (c) "present-day techniques have very little value, if any, in augmenting the precipitation in areas of very low rainfall or during dry periods in regions of normally medium rainfall." Scientifically rigorous experimentation, development of precise methods of evaluation, collaboration with meteorological authorities and exchange of information are recommended. (*Same item as* 6J–289, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Review articles 2. Weather modification bibliographies.**—*G.T.*

**11M–574** 551.509.617(52)

Yamamoto, G. (*Tohoku Univ.*), **Artificial rain-making in Tohoku Region.** *Committee for Rain-making in Japan, Tokyo, Report of Rain-making in Japan*, 1:8–14, **1954.** 3 tables, 3 figs., 3 refs., eq. **DWB**—General account of cloud seeding experiments conducted in the Tohoku region in summer 1953, and of theoretical and synoptic studies undertaken in connection with the experiments. In these experiments AgI generators were operated on the ground. The amount of data obtained is found insufficient for definite conclusions. (*Same item as* 6J–290, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Japan 2. Tohoku, Japan.**—*G.T.*

**11M–575** 551.509.617:551.594.22

**Can we stop lightning?** *The Timberman*, Portland, Oregon, 55(5):58–60, March **1954.** photo. **DLC**—A description of thunderstorm dispersal tests carried out for California Division of Forestry by flyer KENNETH PERRY and reported by FRED HERBERT, chief assistant to the deputy state forester in charge of fire control. The technique used involves flight into thunderclouds and release of "chemicals which cause the clouds to change to stratus type." The test flights were undertaken when storms were fully developed, with cloud bases at 10,000 to 12,000 and tops at 35,000 to 45,000 ft. In the treated area thunderstorms cells disintegrated within 15 min to one hr and 50 min, while lightning activity continued in surrounding areas. The areas treated were 30 mi wide and 60 to 100 mi long. Calculations based on estimated number of fires prevented make the operation appear economically sound. (*Same item as* 6J–220, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding from airplane 2. Thunderstorm suppression.**—*G.T.*

**11M–576** 551.509.617:551.578.7(68)

**Rainmaking—a new twist.** *Chemical and Engineering News*, 32(43):4352, Oct. 25, **1954. DLC**—At Longkloof, South Africa, farmers are practicing hail control by means of rockets dispersing AgI crystals. The technique was suggested by H. KRITZINGER of Stellenbosch University. The cost of a rocket is $14. "In a matter of minutes after the rockets are fired, harmless rain falls from menacing hail clouds." (*Same item as* 6J–265, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Hail prevention in South Africa 2. Silver iodide rockets 3. Longkloof, South Africa.**—*G.T.*

**11M–577** 551.509.617(44)

**Réunion d'automne de l'Association d'Études des Moyens de Lutte Contre les Fléaux Atmosphériques.** [Autumn meeting of the Research Association for the Control of Weather Disasters.] *Puy-de-Dôme. Observatoire, Bulletin*, Ser. 2, No. 4:121, Oct./Dec. **1954.** Also: **Une discussion sur les essais de pluie artificielle à l'Assemblée Nationale.** [Discussion on artificial rainfall experiments before the National Assembly.] *Ibid.*, p. 122–124. refs. **DWB**—The first item is a note on hail control activities in the Aquitaine basin, France, in the 1954 season, which was the 4th year of silver-iodide seeding in that area. In 1954 the hail control network consisted of 70 ground-based generators arranged in several lines. The small number of hailstorms during the operations justifies continuation of the project in 1955. The second paper is a verbatim passage from the official minutes of the parliamentary debate of July 22, 1954. In reply to a question by A. Rey, the Secretary of Commerce of France, P. Monin, explains the circumstances under which a 2-year contract involving 70 million francs was concluded between Electricité de France and the Water Resources Development Corp. of the U. S. Dissatisfied with the Secretary's explanation, Rey expresses indignation because the contract was awarded to a foreign corporation of doubtful scientific standing, while highly rated research organizations in France, equally capable of conducting cloud-seeding experiments, have to pursue their studies on less than 10% of the sum made available to the American "rainmakers." (*Same item as* 6J–267, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Hail prevention in France 2. Cloud seeding in France 3. France.**—*G.T.*

**11M–578** 551.574.1:551.509.616/7

**Works on cloud physics and artificial rain carried out in India.** *Pan Indian Ocean Science Congress, Aug. 1954, Perth, Western Australia, Proceedings of Section A, Physical Sciences*, p. 71–79. Also: **Symposium on Artificial Rain held at New Delhi on Feb. 9–10, 1953.** *International Union of Geodesy and Geophysics, Bulletin d'Information*, 3(5):161, April **1954. DWB**—The Proceedings contain brief abstracts of the papers read at a symposium in New Delhi in Feb. 1953. They include twenty papers on cloud physics and artificial precipitation, dealing, in particular with experiments conducted by the Indian Meteorological, Agricultural, Irrigation and Industrial Research Departments. (For published Proceedings *see* 11M–658). *Subject Headings:* **1. Cloud physics 2. Artificial precipitation 3. India.**—*N.N.*

## 1955

**11M–579** 551.509.617(729.5)

*Alpert, Leo (*Capitol Res. & Dev. Corp., Arlington, Va.*), **Silver iodide cloud seeding in Puerto Rico.** *American Geophysical Union, Transactions*, 36(2):227–234, April **1955.** 5 figs., 2 tables, 16 refs. **DWB, DLC**—The results of field work in Puerto Rico in Nov., 1953, as a consultant for the Puerto Rico Water Resources Authority to investigate the possibilities of stimulating rainfall through cloud seeding with silver iodide ground generators are reviewed. Few opportunities for cloud seeding with silver iodide ground generators were observed. Most often rain fell from warm cumulus clouds with tops between 8000 and 12,000 ft, far below the −5°C level between 17,000 and 18,000 ft where silver iodide first becomes effective as a nucleating agent. Few Cumulus grow to the −5°C level between 17,000 and 18,000 ft. Those that were observed to grow to the −5°C level where silver iodide crystals might be effective started to give rain when the tops were between 8000 and 12,000 ft, and those clouds usually yielded such intense showers that seeding to increase the fall might result in destructive erosion and floods. An analysis of the meteorological records for the dry season indicates that the trade inversion would form an effective ceiling to the penetration of the silver iodide smoke aloft. (*Same item as* 6J–291, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Puerto Rico 2. Height of tropical cumulonimbus clouds 3. Rain from nonfreezing clouds 4. Puerto Rico**—*Author's abstract.*

**11M–580** 551.509.617

Arizona. Univ. Institute of Atmospheric Physics, **Progress Report, No. 2.** Nov. 30, **1955.** 24 p. 7 figs., 2 tables. **DWB**—A thorough summary of scientific activities of the Institute of Atmospheric Physics during the year 1955. Height of base and top of initial rain formation in clouds, percent of echoes in <freezing layers at base and top, percent reaching ground and percent showing top growth after formation are tabulated for 10 days in July and Aug. 1955, when activity was high. About half of all precipitation cores in Arizona fail to reach the ground before evaporating. Also the average height of formation is greater than in Midwest or Caribbean, and the formation layers usually straddle the zero isotherm, whereas in the Caribbean many more occur at temperatures above freezing. No confirmation of the Bowen meteoric dust theory could be obtained from experiments conducted with Bowen's assistance, yet results in Sydney and Hawaii (at 10,000 feet) gave positive results during the same period (Jan., 1955). A tentative hypothesis to account for uniform time lapse (30 days) is found in experiments with an allotropic form of silica called tridymite which

would form at a constant temperature and settle at a uniform rate and which shows strong nucleating properties. *Subject Headings:* **1. Cloud physics research I. Braham, Roscow R., Jr.**—*M.R.*

**11M–581** **551.509.617**

Aujeszky, László, **A mesterséges esőkeltés újabb fejleményei.** [Recent developments in artificial stimulation of rainfall.] *Hidrológiai Közlöny*, Budapest, 35(3/4):137–142, March/April **1955.** fig., 3 photos (inserted between p. 116 117), 16 refs. **DWB**—In this thorough review of current problems in cloud seeding the author discussed: 1) the physics of precipitation, 2) selection of meteorological conditions favoring seeding, 3) various seeding agents, 4) feasibility and usefulness of systematic cloud seeding, 5) impact of cloud seeding on hydroelectric power and 6) the question whether artificial precipitation occurs at the expense of natural precipitation. It is contended that the hydrologic cycle may be intensified by artificial precipitation (increased evaporation as a result or precipitation increase) and thus a higher general rainfall amount (instead of a mere re-distribution) may be obtained. (*Same item as* 6J–292, Oct. 1955, *Met. Abs.*) *Subject Heading:* **1. Artificial precipitation.**—*G.T.*

**11M–582** **551.509.617:551.578.7**

Beck, F. X., **Hagel-Abwehr.** [Hail prevention.] *Umschau*, 55(13):404–406, July 1, **1955.** 4 figs., 2 refs. **DLC**—A sketch is given of the formation of hail in a cumulonimbus. Prevention is by the introduction of condensation nuclei (AgI) which inhibit excessive supercooling. Airplanes and surface generators do not take them high enough, but rockets can penetrate the supercooled region and are simple and cheap. Early recognition of a dangerous cloud is essential; this can be by radar and by warnings from a central office. (*Same item as* 6F–378 and 6J–293, *Met. Abs.*) *Subject Headings:* **1. Hail prevention 2. Overseeding.**—*C.E.P.B.*

**11M–583** **551.509.61(67)**

Berényi, Dénes, **Újabb kisérletek mesterséges eső előállítására Keletafrikában.** [Recent experiments on artificial stimulation of rainfall in East Africa.] *Időjárás*, Budapest, 59(2):126–127, March/April, **1955. DLC**—Describes balloon bomb technique for obtaining precipitation from non-freezing clouds by seeding with hygroscopic nuclei as practical in East Africa and reported by D. A. Davies (*see* 11M–328 and –494). (*Same item as* 6J–294, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with hygroscopic nuclei 2. Balloon bomb technique 3. East Africa. I. Davies, D. A.**—*G.T.*

**11M–584** **551.574.2**

Birstein, Seymour J., **The role of adsorption in heterogeneous nucleation, Pt. 1, Adsorption of water vapor on silver iodide and lead iodide.** *Journal of Meteorology*, 12(4):324–33, Aug. **1955.** 13 figs., 8 refs. **DLC**—The adsorption of water vapor on silver iodide and lead iodide was measured, to determine whether a relationship exists between the ability of a particle to take up water vapor on its surface and its nucleating ability. It was found that nucleating ability is closely linked with the capacity of a solid to absorb water vapor on its surface. From the adsorption isotherms on the silver iodide and lead iodide at −20°C, and supplementary experiments, it was determined that it is not necessary for the nucleating system to go through water saturation before ice-crystal formation can occur. For **Pt. 2,** *see* 11M–691. (*Same item as* 6I–131, Sept. 1955, *Met. Abs.*) *Subject Headings:* **1. Silver iodide nuclei 2. Lead iodide nuclei 3. Nuclei adsorption properties 4. Ice crystal formation.**—*Author's abstract.*

**11M–585** **551.509.6(73)**

Blumenthal, Fred, **Scientists are changing the weather.** *Washington Post Parade Magazine*, April 3, **1955.** p. 10–12. photos, diagr. **DLC**—Popular article giving the optimistic claims of cloud-seeders or "rainmakers" (extinguishing forest fires, clearing holes in clouds for rescue operations, fog dispersal for airports or moving picture production, snow making for various purposes, seeding hurricanes, curing drought, etc.) followed by notes on conservative side and the work of the Orville Commission which must make its report by June 30, 1956 on the facts of this controversial subject. Methods, benefits and extent of operations are then discussed. (Only 10 states have not had seeding experiments.) Map shows location of seeding trials in U. S. A. (*Same item as* 6J–296, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Weather control 2. United States.**—*M.R.*

**11M–586** **551.577.5:551.509.617(794)**

Bollay, Eugene, **Methods and results of large scale applications of cloud seeding in the Western United States.** *Archiv für Meteorologie, Geophysik und Bioklimatologie, Ser. A*, 8(3):299–318, **1955.** 8 figs., 2 tables, 15 refs. English, German and French summaries p. 299. **DWB**—The economic benefits of even a small increase of precipitation in the dry lands of U. S. A. would be so great that

large scale seeding trials were justified. Results of over 50,000 hours of AgI smoke generation are described, including a full scale trial in Santa Barbara County. Evaluation (by the State of California Water Resources Board) was by comparison of rainfall in target and control areas. Precipitation in targets exceeded that in controls by up to 95%; the probability that this arose by chance was of the order of .01. (*Same item as* 6J–297, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Western U. S. 2. Santa Barbara County, Calif.**—*C.E.P.B.*

**11M–587** 551.509.6

Brundidge, Harry T., **The weather is changing.** *American Mercury*, N. Y., 90(374):17–19, March **1955. DWB**—A brief popular account of the effects of atom bombs and rain makers vs. natural climatic changes and possibility of control through regulation of solar energy by dust or $CO_2$ control, and of observation from an asteroid about 400 mi from earth. (*Same item as* 7.4–124, April 1956, *Met. Abs.*) *Subject Heading:* **1. Weather control.**—*M.R.*

**11M–588** 551.509.617:016

†**Bibliography of published reports on cloud physics and weather modification.** [**1953.**] *California. State Water Resources Board, Bulletin*, No. 16 (Append. B): 69–78, June **1955.** entirely refs. **DWB**—Reference is made to the **Selective Annotated Bibliography on Cloud Physics and Rain Making,** in *Meteorological Abstracts and Bibliography*, March 1950, to a bibliography on the same subject in the *American Geophysical Union, Transactions*, Dec. 1952, and to a bibliography on nuclei added to Appendix G of this Bulletin. Published reports which do not appear in any of the mentioned bibliographies are listed here. The list includes some 120 references to literature on cloud physics, precipitation mechanics and weather modification. American and foreign literature is covered up to Sept. 1953. (*Same item as* 6J–295, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud physics 2. Weather control 3. Weather modification bibliographies.**—*G.T.*

**11M–589** 551.509.617

*†California. State Water Resources Board, **Bulletin, No. 16,** June **1955.** 271 p. diagrs. (fold.), charts (fold.), tables, numerous refs. 9 appendixes (p. 58–271). **DWB**—This collection of work on weather modification done under the authority of the California Department of Public Works, Division of Water Resources, contains a description of the organization and authority under which the investigation was undertaken; a summary of the theory of weather modification; a history of cloud physics research and weather modification activities in general and in California (detailed list of recent weather modification operations in California), in particular and a discussion of evaluation methods used by various agencies and those adopted by the reporting agency. Nine supplements—reports prepared under the project—are added as Appendix A–I, as follows:

A: **Laws pertaining to weather modification enacted by 1951 California Legislature.** p. 58–68.
B: **Bibliography of published reports on cloud physics and weather modification.** [**1953**] p. 69–78. (*See item* 11M–588.)
C: Jeeves, T. A., et al., **On the methodology of evaluating cloud seeding operations.** April and Oct. **1953.** p. 79–125. (*See item* 11M–613.)
D: Court, Arnold, **Evaluation of weather modification operations of the southern Sierra project.** Oct. **1953.** p. 126–145. (*See item* 11M–591.)
E: Neiburger, M., **Selection of predictors for statistical forecasting of rainfall amounts in the "Carrizo-Tremblor" area of California.** May **1952.** p. 146–162.
F: Vernon, Edward M., **Report on classification of storms for statistical evaluation with special reference to Carrizo plain and Santa Maria coastal areas.** Feb., May, Oct. **1953.** p. 163–193. (*See item* 11M–665.)
G: Snyder, N. W. and Dhanak, A. M., **A study of the measurement of sublimation nuclei by means of ice crystal count and their activation due to temperature.** Aug. **1953.** p. 194–210.
H: Craig, Gavin M., **Legal report on liabilities involved in creation of artificial rainfall and powers of the state to regulate the same.** Aug. 1950, Nov. **1953.** p. 211–257. (*See item* 11M–592.)
I: **Economic report on possible benefits of weather modification operations.** Sept. **1952.** p. 258–271. (*See item* 11M–590.)

(*Same item as* 6J–298, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Weather control 2. Cloud seeding evaluation I. California. Dept. of Water Resources.**—*G.T.*

**11M–590** 551.509.617

**Economic report on possible benefits of weather modification operations. Sept. 1952.** *California. State Water Resources Board, Bulletin*, No. 16:258–271, June **1955.** table. **DWB**—A rough estimate of the economic effect of a 10% increase in annual precipitation shows that such an increase

would raise the value of dry-farm lands in the Dakotas and Nebraska by 50% and the number of farms might be increased by 30%, thus supporting an additional 56,000 families; in an irrigated region of the San Joaquin Valley, Calif., 10% additional land could be brought under irrigation and power production could be increased considerably. Substantial benefits could also be derived for terrace land, foothills, range land and mountain areas in the regions investigated. (*Same item as* 6J–304, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Weather control benefits 2. Rainfall increase effects.**—*G.T.*

**11M–591** **551.509.617**

Court, Arnold (*California Univ., Statistical Lab.*), **Evaluation of weather modification operations of the Southern Sierra project. Oct. 1953.** *California. State Water Resources Board, Bulletin,* No. 16:126–145, June **1955.** 4 figs. (fold.), 5 tables. **DWB**—Weather modification efforts made during the 1950/51 and 1951/52 seasons over a 2200 sq mi area on the western slopes of southern Sierra Nevada are evaluated by means of a modified regression method comprising differentiation according to 3 precipitation types (Type I, weakening northerly, favoring Yosemite; Type IV, strong westerly, favoring southern Sierra and Type VI, intermediate, favoring neither). Each of regression lines indicates a relative increase of precipitation in the target area. The probability of this increase being due to a cause other than chance is less than $\frac{1}{2}$ if all storms are considered; but if only operational storms are considered, the chances are 85%, 89% and 58% for the four Type I, six Type IV and fourteen Type VI storms, respectively. (*Same item as* 6J–300, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in California 2. California.**—*G.T.*

**11M–592** **551.509.617:34**

Craig, Gavin M., **Legal report on liabilities involved in creation of artificial rainfall and powers of the state to regulate the same. Aug. 1950 and Nov. 1953.** *California. State Water Resources Board, Bulletin,* No. 16:211–257, June **1955.** refs. Addendum, p. 255 257. **DWB**—Some of the complex legal problems connected with a landowner's right in natural rainfall, liabilities of an artificial precipitator, public weather modification and liability therefore, and the state's right to regulate weather modification activities, are discussed in detail. Attempts to give approximate definitions of the extent of these rights and liabilities. "Subject to whatever inherent difficulties there might be in establishing the necessary facts, some degree of liability for damage caused by artificial precipitation to persons or property seems assumed." (*Same item as* 6J–301, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Weather control legislation 2. Legal aspects of weather control.**—*G.T.*

**11M–593** **551.509.617**(678.2)

Davies, D. A.; Sansom, H. W. and Rana, G. Singh, **Report on experiments on artificial control of rainfall at Amboseli, Kenya, and Dodoma, Tanganyika, 1953–54.** *East Africa. Meteorological Department, Memoirs,* Vol. 3, No. 3, **1955.** 21 p. figs., tables, refs. **DWB**—Describes experiments made in southern Kenya (Oct.–Dec. 1953) and Tanganyika (Jan.–March 1954). Finely ground salt was dispersed by the balloon bomb method. Details of the operations and their results are given. Evaluation of the experiments is based on visual observation; the results, nevertheless "fully confirm several deductions made from the 1952 Kongwa experiments which were based on an objective analysis of rainfall records." The general effect of the operations appeared to be light showers following the release of hygroscopic particles in suitable large cumulus clouds. (*Same item as* 6J–357, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in East Africa 2. Rain from nonfreezing clouds 3. Amboseli, Kenya 4. Dodoma, Tanganyika.**—*G.T.*

**11M–594** **551.509.617**(675)

Dessens, H., **Etudes sur les nuages équatoriaux.** [Study of tropical clouds.] *Puy-de-Dôme. Observatoire, Bulletin,* Ser. 2, No. 3:76–79, July/Sept. **1955.** photo., 6 refs. **DWB**—The object of the research referred to in this summary report was to study tropical clouds (at Lukolela, Belg. Congo) from the point of view of their suitability for seeding with (a) ice or (b) hygroscopic nuclei. The factors investigated in particular were: (a) existence of convective clouds with tops above the freezing level and lack of natural active freezing nuclei near the tops of such clouds and (b) existence of fairly developed convective clouds not reaching up to the freezing level and lack of large hygroscopic nuclei at the given place and time. Preliminary results of the study appear to indicate that conditions in Lukolela frequently favor cloud seeding with both ice and hygroscopic nuclei. Experiments with both types of nuclei were attempted by means of ground-based silver iodide generators and by rockets dispersing salt at 1300 m. For the former method no suitable means of evaluation was available; the latter does not appear to have yielded any precipitation. The author believes that natural precipitation originating from entirely nonfreezing clouds is negligible in equatorial Africa. (*Same item as* 6J–358, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Belgian Congo 2. Rain from nonfreezing clouds 3. Tropical cloud studies 4. Lukolela, Belgian Congo.**—*G.T.*

**11M–595** 551.574.2:551.509.617

Dessens, H., **Quelques théories de l'ensemencement des nuages soumises au contrôle expérimental.** [Some theories of cloud seeding tested experimentally.] *Archiv für Meteorologie, Geophysik und Bioklimatologie, Ser. A*, 8(3):147–158, **1955.** 6 figs., 32 refs. French, German and English summaries p. 147 149. **DWB**—The importance of the FINDEISEN-BERGERON effect in the first stage of the growth of precipitation is shown by photographs. The effect of seeding by solid $CO_2$ is dismissed briefly. Laboratory and field experiments with silver iodide are discussed, including evaluation of large-scale tests in France. Doubt is thrown on the efficiency of nucleation from ground emitters, unless the cloud is entirely between 0 and −15°C because: a) after passing through a cloud layer at temperature above 0°C AgI particles may lose their efficiency; b) if the summit of the cloud rises above the isotherm of −15°C it may be seeded naturally. (*Same item as* 6J–302, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding techniques.**—*C.E.P.B.*

**11M–596** 551.578.41:551.524.3:551.509.617

D'Ooge, Charles L., **Snowfall and temperature on a Californian mountain.** *Nature*, London, 175(4454):465 466, March 12, **1955.** fig., 7 refs. **DWB**—Snowfall and temperature were measured daily at 10,600 ft on White Mts. in winters 1948–54. Cloud seeding experiments were being made on Sierra Nevada Mts. 30 mi upwind. In 1948–51 dry ice was used and peak snowfall was at −11°C. In 1951–54 AgI was used and main peak was at −4°C with a nearly equal peak at −10°C. (*Same item as* 6J–303, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Temperature of snowfall 2. Cloud seeding 3. Sierra Nevada Mountains, Calif. 4. White Mountains, N. H.**—*C.E.P.B.*

**11M–597** 551.578.45:551.509.617

D'Ooge, Charles L. (*U. S. Naval Ordn. Test Sta., China Lake, Calif.*), **Snowstorm initiation and air temperature.** *American Meteorological Society, Bulletin*, 36(3):127–137, March **1955.** 2 figs., 5 refs. **DWB, DLC**—Data obtained on White Mountain Research Station, Calif., at 10,600 ft (37°30′N, 118°10′W) since Nov. 1948 are divided into 2 groups: 1) 1948–50, *before* intensive cloud seeding projects were begun 30 mi upwind from the station and 2) 1951–3, *during* these experiments. Analysis is based on daily observations of mean temperature for day (°C) and amount and frequency of snowfall of .1″ or greater. 1948–1951 curves are erratic but show marked maximum at −10° to −11°C; the temperature BOSSOLASCO (1954) found, for the maximum snowfall frequency at Weissfluhjoch. During 1951–53 when AgI generators were used, a secondary peak occurs at −4°C, which at temperature, laboratory experiments show, AgI becomes active as freezing nuclei. At 12,500 ft maximum occurs 3°C lower, as shown on curves for point 7 mi N. W. of the station. (*Same item as* 6J–359, Oct. 1955, *Met. Abs.*) *SubjectHeadings:* **1. Snow initiation temperature 2. Cloud seeding evaluation 3. White Mountain Research Station, Calif.**—*M.R.*

**11M–598** 551.509.617(672)

du Chaxel, Raoul, **Les premières expériences de pluie artificielle en Afrique Équatoriale Française.** [First experiments with artificial rainfall in French Equatorial Africa.] *French Equatorial Africa. Service Météorologique, Publication*, No. 2, July **1955.** 67 p. 2 tables, 7 refs. **DWB** (M(055) F873p)—Experiments, using a mixture of 90% anhydrous NaCl and 10% pure CaCl and 0.25% MgCl, pulverized and heated with infrared rays, with diameter from 75–125$\mu$ and kept for 36 hrs at 115°C, then vibrated for 5 hrs and reheated for 84 hrs to produce crystals of the form of talc, with 1–100$\mu$ size and mean size of 5$\mu$ (much smaller than those used at Kongwa and Madagascar). Preparation at the ground and release from airplane is described, location of Basin (Dimonika) and procedures on the systematic tests of May 11, 12 and 14, 1954 inside and outside the Dimonika Basin on May 11 and 13 (14 tests in all) and occasional tests on June 14, 1954 at Brazzaville; Aug. 3, 1954 at Bangui and on Oct. 6, 1954 at Brazzaville are described in detail with synoptic and upper air conditions outlined for each of the 21 tests. Effect of altitude of seeding was also considered in tests No. 18 and 20. Similar treatment is given to the 18 tests made in Oct.–Dec. 1954 at Niari and 4 in Feb.–March, 1955 at Malolo. Methods of analysis, primary or immediate, and secondary effects were analyzed and the results of water seeding tabulated for 14 cases and for the 29 cases where salt was used; both segregated according to StCu and Cu clouds. Charts show local results on river basins and diagrams show changes in Cu cloud development with height in relation to adiabatic temp. curve. Seven cases failed to produce visible results owing to reasons given. Of the 21 Cu clouds seeded with salt, 13 produced rain, 1 virga, 6 dissipated the cloud, and 1 produced no reaction; of the 4 Cu seeded with water, all produced rain; of the StCu seeded with water, 4 produced precip., one virga, 4 produced secondary reaction and 1 partially dissipated. Of the StCu seeded with salt, one gave large drops, 3 produced secondary reactions, and 2 could not be observed. Results were observed in every case within 16 min, and often within 3 min. Seeding at 300 m above base of cloud (with salt) is recommended. (*Same item as* 10.1–184, Jan. 1959, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with salt 2. Cloud seeding with water 3. French Equatorial Africa.**—*M.R.*

**11M–599** 551.509.615

Dufour, L., **Kan men de mist kunstmatig doen verdwijnen?** [Can fog be dispersed artificially?] *Hemel en Dampkring*, The Hague, 53(7):132–135, July **1955.** 16 refs. **DWB, DLC**—The scientifically based methods for dispersing natural and artificial fog are classified and described, and their effectiveness is evaluated. These methods comprise the dispersal of mist by evaporation caused by warming and by reduction of water vapor; dispersal by ionization of the air containing fog droplets, and dispersal by means of precipitation. (*Same item as* 8.8–177, Aug. 1957, *Met Abs.*) *Subject Headings:* **1. Artificial fog dissipation 2. Fog.**—*I.L.D.*

**11M–600** 551.509.68:662.2:539.1

†Dunning, Gordon M. (*U. S. Atomic Energy Com., Wash., D. C.*), **Effects of nuclear weapons testing.** *Scientific Monthly*, 81(6):265–270, Dec. **1955.** 24 refs. **DWB, DLC**—Among other things, the author considers the possible relationships between test nuclear explosions and the weather. Some of the effects suggested are listed and disproved. (*Same item as* 7E–135, May 1956, *Met. Abs.*) *Subject Headings:* **1. Atomic explosion effects on weather.**—*I.L.D.*

**11M–601** 551.509:6 551.509.617

Edson, Lee, **The world's best weatherman.** *Better Homes*, Des Moines, Iowa, 33(1):48–49, 100–105, Jan. **1955.** photos, diagrs. **DWB**—A well illustrated article describing the advances in meteorology during the past 20 years which can be attributed to DR. KRICK and his genius. Among these are: 1) modernizing the forecasting procedures of the U. S. Weather Bureau after the fact that KRICK's forecasts were 95% correct while the Weather Bureau's were only 65%; 2) development of short and long range forecasting by analogs for commercial interests; 3) forecasting and advising for D-Day landing and the Rhine crossing of allied forces; 4) development of modern industrial meteorology and 5) large-scale cloud modification or rain making developments and operations. (*Same item as* 6J–305, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Industrial meteorology 2. Cloud seeding 3. Weather forecasting 4. Krick, Irving.**—*M.R.*

**11M–602** 551.574.1:551.509.617(45)

Fea, Giorgio, **Il programma Italiano sulle ricerche di fisica delle nubi (Collaborazione tra il Servizio Meteorologico dell'Aeronautica Militare e l'Istituto Nazionale di Geofisica).** [Joint cloud physics research program of the Italian Meteorological Service and the Italian Institute of Geophysics.] *Rivista di Meteorologia Aeronautica*, Rome, 15(1):16–20, Jan./March **1955.** 5 refs. French, English and German summaries p. 16. **DLC**—The Italian cloud physics research program comprises: a) observation of natural phenomena (nuclei, cloud structure, electricity in clouds, dynamics of clouds), b) reproduction of such phenomena in the laboratory (cold chamber experiments) and c) experiments aimed at modifying natural phenomena. Cloud seeding experiments carried out by means of silver iodide nuclei in various parts of Italy are briefly mentioned. (*Same item as* 6J–360, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud physics research 2. Cloud seeding in Italy 3. Italy.**—*G.T.*

**11M–603** 551.578.7(492)

Feteris, P. J., **£330,000 hail damage in fifteen minutes, analysis of a devastating hailstorm.** *Weather*, 10(7):223–232, July **1955.** 5 figs., photo, 7 refs. **DWB**—On June 19, 1954 a cold front lay over the North Sea with widespread thunderstorms in warm air to east and wet adiabatic lapse 700–250 mb. Violent hailstorms raged over southern Zeeland in the Netherlands. In Zuid Beveland size distribution, time and duration of hail and accompanying lightning are plotted. In the central belt 6–4 km wide hailstones were as large as hens' eggs (30–60 mm). Storms also occurred in Groningen and Friesland. Causes of different types of hail, and their distribution in the storm, are discussed. Transparent hail was due to coalescence of about 60 large half-frozen drops. Updraught is estimated as 10–20 m/s. Prevention of storms by overseeding would be possible but very difficult. (*Same item as* 6.10–238, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Hail damage 2. Hailstorm size 3. Hailstorms 4. Netherlands.**—*C.E.P.B.*

**11M–604** 551.509.617:551.577.21(54)

Fournier d'Albe, E. M.; Lateef, A. M. A.; Rasool, S. I. and Zaidi, I. H., **The cloud-seeding trials in the central Punjab, July–September 1954.** *Royal Meteorological Society, Quarterly Journal*, 81(350):574–581, Oct. **1955.** 3 figs., plate, 2 tables. **DWB**—Salt particles of $10^{-9}$ to $10^{-8}$ g were heated by 5–10°C and forced through hand-operated blowers at Lahore and Jaumarabad on 39 days with convective clouds. Rainfall within 100 km on a 50° arc downwind, relative to normal, was significantly higher than in neighboring unseeded arcs. Clouds are below freezing level. (*Same item as* 6J–361, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Pakistan 2. Pakistan.**—*C.E.P.B.*

**11M–605** 551.509.617

Gardner, Charles, Jr. (*Ex. Sec., Advisory Committee on Weather Control*), **Hauling down more water from the sky.** *U. S. Dept. of Agriculture, Yearbook,* ——. pub. **1955.** p. 91–95. **DA, DWB, DLC**—A popular article dealing with the formation of rain, the production of artificial precipitation, the statistical evaluation of the effectiveness of cloud seeding and the program of the Advisory Committee on Weather Control. (*Same item as* 6J–306, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Cloud seeding evaluation 3. U. S. Advisory Committee on Weather Control.**—*I.L.D.*

**11M–606** 551.509.617:551.574.2

Gardner, Charles, Jr. (*Exec. Sec., Advisory Committee on Weather Control*), **Operation overseed.** *Mt. Washington Observatory, Gorham, N. H., Bulletin,* No. 28:2–4, Dec. **1955. DWB**—Attempts have been made since Oct. 17, 1955 to show whether or not AgI seeding from ground generators is effective, by an intensive project on and around Mt. Washington, N. H., where supercooled clouds occur 9 months of the year. Several ground generators were located at different places around the peak (observatory). No conclusive answers will be reached until the spring of 1956. The final report, by June 1, 1956, will tell (a) if negative, that such operations are ineffective and (b) if positive, the extent of increment that can be expected. (*Same item as* 8.4–142, April 1957, *Met. Abs.*) *Subject Headings:* **1. Operation overseed 2. Cloud seeding with silver iodide 3. Artificial precipitation 4. Mt. Washington, N. H.**—*M.R.*

**11M–607** 551.509.617(71)

Godson, Warren L., **Report on evaluation of cloud-seeding operations in Manitoba and Saskatchewan.** *Canada. Meteorological Division, Circular,* CIR-2649 TEC-215, May 2, **1955.** 38 p. 3 figs., 14+8 tables, refs., 11 eqs. Also: American Institute of Aerological Research (Denver, Colo.), **Comments [on the above].** Its *Report* No. 274, July **1955.** unp. 5 figs., table. **DWB**—Commercial seeding operations have been carried out for the months May to July in an area in southwest Manitoba (1953, 1954) and in an area in central Saskatchewan (1954). These operations have been evaluated by a multiple regression technique involving a number of control areas. Extensive statistical tests have been carried out on monthly areal-mean precipitation data and on regression estimate errors. A suitable technique for the combination of estimate deviations from different areas, months, and years has been developed, together with techniques for assessing the significance of such a combined estimate of seeding effects. These techniques are applied to the operations mentioned above. It is found that the best estimate of the effect of cloud seeding (AgI ground generators) is that it has produced a decrease in precipitation, amounting to 14.1% of "natural" precipitation. The 95% confidence range for the seeding effect is between decreases of 0.2 and 24.6%. There is no indication of any significant differences between areas, months or years. (*Author's abstract.*) In the **Comments** the shortcomings of the evaluation methods applied by GODSON are subjected to severe criticism on the following counts: 1) Some of the control areas used were influenced by seeding, 2) The regression method used did not have sufficient accuracy, 3) Short seeding periods were combined with long nonseeding periods, thus obliterating the effects, 4) No attempt has been made to utilize the more refined methods recently worked out at the University of California, 5) "On the strength of an unsound statistical (instead of physical) assessment, GODSON proceeds to draw conclusions concerning the physical conduct of the operations." (*Same item as* 6J–307, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding evaluation 2. Cloud seeding in Canada 3. Canada.**—*G.T.*

**11M–608** 551.509.617 551.509.58:63

Great Britain. House of Commons. **Meteorological Office.** Its *Parliamentary Debates* (Hansard), 542(12): col. 1290–1291, June 22, **1955. GB–MD**—Questions and replies about experiments in rain-making in Britain and weather forecasts for farmers. *Subject Headings:* **1. Artificial precipitation 2. Great Britain.**—*C.E.P.B.*

**11M–609** 551.509.617(792)

Hales, J. Vern; Hoffer, Thomas E. and Peck, Eugene L. (*all, Univ. Utah*), **Area average evaluation of the effects of cloud seeding in Southern Utah.** Prepared for the American Association for the Advancement of Science, June 23, **1955.** 10 p. 2 figs., 10 refs. **DWB**—Continuing tests of rainfall variability in Southern Utah and significance of cloud seeding operations in that region (*see* 11M–610 and 11M–507), the authors have tested precipitation for 23 winter months (1951–4) against 73 months (1941–51) when no seeding occurred in that area, and also performed inter-regional evaluations. Indications are that deviations from the mean of 5.4% occurred in the seeded area at the 0.16% level, and of 12.6%, at the 0.01 level, whereas the chance that there was a real increase of 10% would be 0.032 and probability of 20% was 0.0001; thus failing to support claims of a significant

increase of 20% to 30% for seeded areas (though the latter claims were based on 36 months of seeding in winter and summer, rather than 23 months of winter data alone). Trends likewise do not appear significant as greater slope has been found in earlier nonseeding years. Regression lines are shown on scatter diagrams. (*Same item as* 8.6 168, June 1957, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding evaluation 2. Southern Utah.**—*M.R.*

**11M–610** 551.509.617(792)

Hales, J. Vern; Hoffer, Thomas E. and Peck, Eugene L., **An evaluation of the effects of cloud seeding in southern Utah, April 1951 November 1954.** *Utah, University, Bulletin*, 46(15), June 1955, 39 p., figs., photos. **DWB**—The intricate problems of statistical evaluation of cloud seeding operations are discussed in a way easily understood by the layman. In a popular question-and-answer form, the "area average test" applied to the Utah operations is explained. The various steps involved in the test are illustrated with diagrams and photographs. It is found that "the cloud seeding did not change the area average percent of normal precipitation." The bulletin includes criticism of reports circulated by the contractor's representative (*Same item as* 6J 308, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding evaluation 2. Cloud seeding in Utah 3. Utah.**—*G.T.*

**11M–611** 551.509.617(797)

Hall, W. Ferguson (*U. S. W. B. Scientific Services Div.*), **The Weather Bureau ACN Project.** Talk presented at the 135th national meeting of the American Meteorological Society, N. Y., Jan 24, 1955. Wash., D. C., U. S. Weather Bureau, Feb. 1, 1955. 11 p. table, ref. **DWB**—A total of 60 operational flights to test dry ice seeding were made in western Washington State from March to May 1953 and Sept. 1953 to May 1954, under a wide variety of cloud conditions attending storms. Only 35 occasions proved satisfactory (22 seeding and 13 control cases) and several good storms were missed or interruption in seeding occurred because of icing of aircraft. Five evaluations have been made: (1) multiple regression with full target, (2) with small target, (3) space-time interpolation, (4) simple time interpolation and (5) interpolation of results. Visual effects of seeding were noted in most cases, regardless of the amount of dry ice distributed in the cloud or the method of distribution. Targets were often over 100 mi in length. In 22 periods (66 hours) of seeding 2.25 in. fell; in 13 control periods (44 hours) 1.13 in. fell. The 5th method of evaluation gives confidence at 5% level of an increase centered at .008" per hour and extending from −.001 to +.017. These conclusions must be accepted with caution. (*Same item as* 6J 309, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Washington State 2. Cloud seeding evaluation 3. U. S. Weather Bureau Cloud Physics Project 4. Western Washington.**—*M.R.*

**11M–612** 551.509.617

Howell, Wallace E., **Artificial rainmaking.** *Paper Trade Journal*, New York, 139(27):24–25, July 4, 1955. 2 figs. **DLC**—Brief discussion of natural rain formation mechanisms and artificial rainmaking from supercooled or warm clouds. Examples of evaluation are shown in two regression diagrams (Georgetown, S. C., and Escalawapa watershed, Ala.-Miss.). Large increases in rainfall as a result of cloud seeding are mentioned. (*Same item as* 6J 311, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Cloud seeding evaluation.**—*G.T.*

**11M–613** 551.509.617(794)

Jeeves, T. A.; LeCam, L.; Neyman, J. and Scott, E. L., **On the methodology of evaluating cloud seeding operations. Report of the Statistical Lab. of the Univ. of California to the Div. of Water Resources, State of California.** April 1953. 49 p. 13 figs., 4 tables, 6 refs. **DWB** (MO9.67 C153o). Also issued as *California. State Water Resources Board, Bulletin*, No. 16:79–125, July 1955. **DWB**—The report presents (1) analysis of two frequently used methods of evaluating cloud seeding operations, the method of percent of normal and the regression method, (2) brings out what appears to be a common but thus far unnoticed phenomenon, namely, that the relation between the rainfall in two adjoining areas (target and control) varies from one type of storm to another, (3) a suggested modification of the regression method, (4) an analysis of the Carrizo Plain cloud seeding operations of 1950/51 and of 1951/52 by means of the modified method of regression, and (5) an outline of an experiment capable of producing real documentary evidence of the effectiveness of cloud seeding. (*Same item as* 5.5 73 and 6J 313, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding evaluation 2. California.**—*From author's abstract.*

**11M–614** 551.509.617:519.2

Jenkinson, A. F., **Some statistical aspects of a rain-making experiment.** *Great Britain. Meteorological Research Committee, M.R.P.* 931, Sept. 14, 1955. 15 p. 18 figs., 13 tables, 7 refs. Mimeo. **DWB**—The problem is to test results of seeding with silver iodide on Salisbury Plain. The location of the plume and vertical and horizontal extent of effective seeding in cloudy frontal conditions are

discussed. From rainfall statistics on 92 selected occasions in 1945–54 it is concluded that if the trials are made with 5 generators on a line of 20–25 mi on suitable occasions, a difference of 13% between rainfall of known seeded and control areas would be significant at 1% level. If the seeded area is not known, a difference of 25–30% would be required. (*Same item as* 7.5–102, May 1956, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding evaluation 2. Statistical techniques 3. Salisbury Plain, Eng.**—*C.E.P.B.*

**11M–615** 551.509.617:676.1

Krick, Irving P., **The value of weather modification operation to the pulp and paper industries.** *Pulp and Paper Magazine of Canada*, 56(3):263–274; 297, **1955.** 15 figs., 2 tables, 16 refs. **DA**—Describes the application of weather modification to benefit the pulp and paper industries through rain stimulation and lightning suppression. The author relates the necessary steps for successful operations to increase precipitation and illustrates these with the analysis of three projects operated in Canada, the U. S. and Spain. Although lightning suppression is still in an experimental stage, the author feels that operations would be successful since in an area of continuous cloud seeding operations strong indications are given, as illustrated by statistics from the U. S. Forest Service, that weather modification could reduce lightning threats. The technical and scientific progress achieved and future development are briefly outlined. (*Same item as* 6J–314, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding 2. Lightning prevention.**—*Author's abstract.*

**11M–616** 551.509.617:63

Krick, Irving P., **We can help the clouds to rain.** *Farmer & Stock-Breeder*, London, 69(3417):61, 63, April 19/20, **1955.** Photos, graph. **DA**—The author explains how a supply of artificial condensation nuclei will increase the fall-out of water from rainclouds and also prevent the development of large hailstones. Benefits accruing to agriculture from an increase in precipitation amount are discussed. (*Same item as* 6J–315, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding 2. Effects of rainfall increase.**—*G.T.*

**11M–617** 551.578.11

Krishna Rao, P. R. and Ganesan, V. (*Reg. Met. Centre, Madras*), **Rain from non-freezing clouds over Madras.** (In: Symposium on Artificial Rain, New Delhi, Feb. 1953, **Proceedings and Papers.** pub. **1955.** p. 33–39. photo., table, 4 refs.) **DWB**—An examination of the data provided by airplane meteorological flights made twice daily by R.A.F. at Madras in the year 1944 46 and the weather diary maintained at the ground station shows a number of instances when rain occurred from clouds which did not extend above the freezing level. Such instances of rain from nonfreezing clouds during the northeast monsoon seasons of 1944 and 1945 have been collected and details of the height and temperature of base and top of the clouds and thickness of the clouds, freezing level, etc., have been given. The clouds were mostly cumulus and the precipitation was in the nature of showers or light or moderate rain. Showers and moderate rain occurred from cumulus clouds of 4000 ft or more thickness. An interesting example of rain from non-freezing clouds near Masulipatam, reported by airline pilots in the field of a cyclonic storm which had weakened into a depression, has been given. Two photographs of rain falling from a growing cumulus cloud which was below the freezing level are appended. (*Same item as* 8.3–267, March 1957, *Met. Abs.*) *Subject Headings:* **1. Rain from nonfreezing clouds 2. Madras, India.**—*Author's abstract.*

**11M–618** 551.509.617:016

†Krick, Irving P. (*comp.*), **A bibliography of weather modification and field operations, using the combined facilities of Irving P. Krick, American Institute of Aerological Research and Water Resources Development Corporation.** Denver, Colorado, American Institute of Aerological Research, Aug. 31, **1955.** unpaged. mimeog. **DWB**—A list of some 200 lectures or reports prepared from 1947 to 1955 and including the 104 items listed in an earlier bibliography (*see item* 11M–429) and reprinted in *Meteorological Abstracts and Bibliography*, 4(8):963–968, Aug. 1953. *Subject Headings:* **1. Artificial precipitation 2. Weather modification bibliographies I. American Institute of Aerological Research I. Water Resources Development Corporation.**—*G.T.*

**11M–619** 551.509.617

Langmuir, Irving, **A critique of the design of experiments on cloud seeding and statistical methods for their evaluation.** *General Electric Research Laboratory*, Schenectady, Report, No. 55-RL-1263, July **1955.** p. 125–168. **DWB**—In this report prepared for the U. S. Advisory Committee on Weather Control, the author gives a detailed account of his observations as a special consultant invited to visit the operation of the Cloud Physics Project of the University of Chicago at Ramey Field, Puerto Rico, Feb. 11–14, 1954. The operation involved seeding of trade-wind clouds with 410 gallons of water dumped into the clouds from airplanes in 18 sec. Meteorological conditions, cloud structure and effects of seeding are discussed. The author also makes several

suggestions for improving evaluation techniques applicable to the seeding of individual clouds from airplanes. He gives numerous examples from his experience with Project Cirrus to support his evaluation scheme. The theoretical basis of LANGMUIR'S suggestions is the hypothesis (supported by evidence) that "seeding of clouds of the proper types produces fundamental changes in the frequency distribution function of the rainfall from seeded clouds. Thus, with inadequate knowledge to guide us in selecting the clouds to be seeded, we should expect to get a few large positive effects and many small or even negative effects." (*Same item as* 6J-316, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with water 2. Cloud seeding evaluation 3. Rain from nonfreezing clouds I. General Electric Research Laboratory.**—*G.T.*

**11M–620** 551.509.617:551.577.33

Langmuir, Irving, **Widespread control of weather by silver iodide seeding.** *General Electric Research Laboratory, Schenectady, N. Y., Report,* No. 55-RL-1263, July **1955.** 175 p. figs., tables, eqs. **DWB**—The author re-asserts his hypothesis of a large-scale effect of cloud seeding with silver iodide and refutes the objections which have been raised against it. The considerable statistical material presented here relates to 37 consecutive 28-day cycles (Nov. 13, 1949–Aug. 13, 1952) 24-hr rainfalls reported by 126 Weather Bureau stations are analyzed as to 7-day periodicities and compared with periodic seedings conducted on a predetermined schedule during 23 of the 37 cycles. In 17 out of the 23 seeded cycles very high periodicities were produced over large parts of the United States, while no comparable periodicities occurred in the 14 cycles during which there was no seeding. Silver iodide seedings made only under favorable conditions (instead of a fixed schedule) are also considered and found to enhance the probability of high periodicities in rainfall. 5 appendices at end are:

A: **Analysis of certain 7-day periodicities in rainfall,** p. 71–76.
B: **Second revision of Chapter 12, Final Report, Project Cirrus (1953),** p. 77–113.
C: **Relation between 7-day periodicity in silver iodide seeding and 7-day periodicity in rainfall and in temperature,** p. 115–124.
D: **A critique of the design of experiments on cloud seeding and statistical method for their evaluation,** p. 125–168. (For abstract *see item* 11M–619.)
E: **Errata for Final Report, Project Cirrus (1953).**

(*Same item as* 6J-317, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with silver iodide 2. Cloud seeding evaluation 3. Large-scale effects of cloud seeding. I. General Electric Research Laboratory.**—*G.T.*

**11M–621** 551.509.617(795)

Lincoln, Russell L., **Analysis of four years of attempts to increase precipitation by cloud seeding in Tri-County area, Oregon, 1950–1954.** *Oregon Agricultural Experiment Station, Corvallis, Miscellaneous Paper,* No. 10 [1955?] 37 p. figs., tables. **DWB**—This paper covers the evaluation of the Tri-County Cloud seeding project conducted in north central Oregon for the four consecutive seasons, Sept. to June, 1950–54. A multiple regression analysis was conceived in which the precipitation in the target on a short period (daily) basis was related to meteorological factors causing the rainfall. IBM cards and machine processing methods were used to determine and apply the quantitative values of the several meteorological factors used. The resulting sensitivity of this multiple regression analysis is such that only a 15.5% increase of measured precipitation for four seasons over that amount mathematically computed to have fallen naturally would be sufficient to declare with 95% confidence (19 to 1 odds) that some outside influence had produced the increase. A net four season positive departure of measured from expected amount of precipitation was shown by this analysis to be between 5 and 6%. (*Same item as* 6J–319, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding evaluation 2. Cloud seeding in Oregon 3. Punched card analysis 4. Oregon.**—*From author's abstract.*

**11M–622** 551.509.617:551.578.4(485)

Ludlam, F. H., **Artificial snowfall from mountain clouds.** *Tellus,* 7(3):277–290, Aug. **1955.** fig., 4 tables, refs., eqs. **DWB**—Physical conditions in low clouds which often form over Scandinavia in winter are analyzed. The problems of ice crystal growth by diffusion, formation of ice crystals as a result of seeding, collision between growing crystals and cloud droplets and conditions favoring snowfall from mountain clouds are taken up. Finally, the performance of cloud seeding generators, the amount of artificial snowfall obtainable from mountain clouds (with application to central Sweden), the cost of seeding operations and problems of cloud seeding evaluation are discussed. It is shown that it is reasonable to suppose that winter snowfall on Central Swedish mountains might be substantially increased by skillful seeding of supercooled mountain clouds. (*Same item as* 6J 362, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Artificial snowfall 2. Cloud seeding 3. Sweden.**—*G.T.*

**11M–623** 551.509.617:551.576.11:551.577.11

Ludlam, F. H., **Planning cloud seeding research.** *Archiv für Meteorologie, Geophysik und Bioklimatologie, Ser. A*, 8(3):283–292, **1955.** 3 figs. English, German and French summaries p. 283. **DWB**—In designing experiments in cloud seeding at Stockholm Institute of Meteorology, attention was first concentrated on studies of natural cumulus by eye and radar from mountain stations and by aircraft. Points being studied are formation and growth, properties of cumulus populations, formation and development of showers, rate of rise of cumulus tops, and "glaciation." Examples are described. (*Same item as* 6J–320, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding research.**—*C.E.P.B.*

**11M–624** 551.509.68:551.510.721:551.515:662:539.1

Machta, L. and Harris, D. L., **Effects of atomic explosions on weather.** *Science*, Wash., D. C., 121(3134):75–81, Jan. 21, **1955.** 6 figs., 14 refs. **DWB**—Various suggested mechanisms by which atomic explosions might influence weather have been reviewed. They include such hypotheses that the atomic debris might serve as a cloud seeding agent, that the radioactive nature of the debris might change the electric conductivity of the free atmosphere, that the dust resulting from atomic explosion might obscure the solar radiation and that the energy of the explosion might affect significantly the weather beyond the testing location. No theoretical reason has been found for believing that the above mechanisms could alter the weather significantly more than a few miles from the explosion site. Increase of tornadoes in 1953 was a reflection of greater accuracy in tornado statistics. Temperature and precipitation anomalies fail to show any relationship to atomic explosions. (*Same item as* 6.8–342 and 6J–321, *Met. Abs.*) *Subject Headings:* **1. Atomic explosions 2. Radioactive fallout 3. Weather control.**—*I.L.D.*

**11M–625** 551.509.617

Mason, B. J., **Design and evaluation of large-scale rain-making experiments.** *Nature*, London, 175(4454):448–451, March 12, **1955.** 7 refs. **DWB**—The present scientific status of rain-making experiments is discussed. Various seeding procedures are described. From methods adopted for statistical evaluation of results "one can find no convincing evidence that large increases of rainfall can be produced consistently over large areas." Physical problems include: how often are natural ice nuclei deficient?; effectiveness of AgI nuclei released from the ground; and decay of AgI nuclei. A proposed test experiment is outlined. (*Same item as* 6J–322, Oct. 1955, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding evaluation.**—*C.E.P.B.*

**11M–626** 551.509.617

Mason, B. J., **The modification of rainfall by large-scale cloud seeding.** *Royal Meteorological Society, Quarterly Journal*, 81(348):284–286, April **1955.** fig. Summary in *Water and Water Engineering*, London, 58(706):530–531, Dec. **1954. DLC**—Seeding of isolated cumulus clouds has increased rainfall but the evidence that large increases can be produced consistently over large areas by release of AgI from the ground is not convincing. An experiment is suggested for testing this. (*Same item as* 6J–323, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding.**—*C.E.P.B.*

**11M–627** 551.509.617

Mason, B. J., **The physics of rain-making.** *Discovery*, Cambridge, 16:461–464, Nov. **1955.** 4 figs., 3 refs. **DLC**—The mechanisms of precipitation release are described in simple language. Coalescence occurs because cloud droplets are of different sizes. Ice crystals grow more rapidly than supercooled water droplets between 0 and −20°C; most layer clouds which produce rain have tops colder than −12°C. Drops in shower clouds increase by disruption. Structure of hail is explained. Artificial stimulation by dry ice from aircraft is effective but costly. Silver iodide smoke is of doubtful efficiency. Seeding warm clouds with salt powder is as effective as with water drops, and cheaper. (*Same item as* 7.9–120, Sept. 1956, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding techniques.** —*C.E.P.B.*

**11M–628** 551.574.2

Miura, Akira (*Tôhoku Univ., Geophysical Inst.*), **On the concentration of silver iodide particles in the atmosphere.** *Tôhoku Univ. Science Reports, 5th Ser., Geophysics*, 7(2):71–81, Nov. **1955.** 9 figs., 14 refs., 11 eqs. **DWB, DLC**—Using experimental results of the large scale diffusion of the smoke particles in the free atmosphere by Braham, Seely and Crozier, and those of the effectiveness of silver iodide smoke particles as freezing nuclei by Bolton and Qureshi, the author calculates the concentration of silver iodide particles as freezing nuclei for the −5°C level and the −20°C level in the atmosphere. (*Same item as* 8.3–253, March 1957, *Met. Abs.*) *Subject Heading:* **1. Silver iodide nuclei.**—*Author's abstract.*

**11M–629** 551.509.617:551.579.4

Moran, P. A. P., **Statistical design of an experiment to test the stimulation of rain.** *Australian Journal of Physics*, Melbourne, 8(4):440–448, Dec. **1955.** 6 tables, 5 refs. **DLC**—The problem of analyzing statistically the results of a C.S.I.R.O. rainfall experiment over the catchment area of the Kiewa River is considered. It is shown that in order to obtain a significant result with any reasonable supposed increase in the rainfall within a few years it is necessary to use a control variable strongly correlated with the test variate. The powers of various tests using either streamflow or rainfall as test variates are calculated when the control variable is either streamflow in the Murray or rainfall in other areas. The general problem of designing such tests and the relationship between rainfall and streamflow are also considered. (*Same item as* 7.9–121, Sept. 1956, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Cloud seeding evaluation 3. Rainfall-streamflow relationships 4. Kiewa River Basin, Australia.**—*Author's abstract.*

**11M–630** 551.509.617(94)

Mull, S. and Chakravarty, K. C. (*Met. Office, Calcutta*), **Suitability of rain-making methods in different parts of India during various seasons.** (In: Symposium on Artificial Rain, New Delhi, Feb. 1953, **Proceedings and Papers.** pub. **1955.** p. 92–103. 3 figs., 4 tables, 20 refs.) **DWB**—The cloud fields (the types of clouds, heights of their bases and tops, their sizes, etc.) in different parts of India and in different seasons, particularly in association with the passage of storms of sea origin and western disturbances, suitable for various types of experiments are examined and discussed with reference to the results obtained so far. The question whether the production of artificial rain in a particular region in India may lead to scarcity of rain in its neighboring region is also discussed. The study reveals that although the scope of artificial rain-making in India, from the practical point of view, is rather limited on account of some characteristic features, such as freezing level being generally high, the frequency of occurrence of clouds without rain at places and times where and when rain is badly needed being low, it may be possible to develop suitable methods for producing artificial rain in certain parts of India and certain seasons after conducting elaborate laboratory and field experiments. The paper contains a brief discussion on the scope of artificial rain-making in India, with particular reference to the prevailing meteorological conditions over the country. (*Same item* 8.3–130, March 1957, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Cloud seeding studies 3. India.**—*Authors' abstract.*

**11M–631** 551.509.617(794)

O'Hanlon, Charles A.; Battle, John A.; Todd, Clement J. and Barr, Neal M., **Cloud-seeding operations in Santa Clara County, California, December 15, 1954–March 15, 1955.** Redlands, Calif., Weather Modification Company, [**1955**]. 42 p. figs., tables, charts. **DWB**—The experiments reported in this document were conducted in Santa Clara County, Calif., during three winter months by means of ground-based and aircraft seeding. With the help of radar (1) the effect produced by seeding in the clouds could be observed, (2) certain shortcomings were found in the generators used and better units were developed and (3) it was ascertained that aircraft generators had a tendency to overseed; this defect was eliminated by the use of a new chemical mixture. Radarscope photographs, data on ground and flight operations and comparative rainfall data (target vs. control area) are presented. Each individual storm is described as to synoptic development and operational details. An average 19% increase in precipitation due to cloud seeding is claimed for the season. (*Same item as* 6J–325, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Radar rainfall observation 2. Cloud seeding evaluation 3. Cloud seeding in California 4. Santa Clara, California. I. Weather Modification Company, Redlands, Calif.**—*G.T.*

**11M–632** 551.509.617:551.578.7(45)

Pastorini, F. M., **Organizzazione ed esito della lotta antigrandine in provincia di Torino nell'anno 1954.** [Organization and outcome of hail control in Torino Province in 1954.] *Cronache Economiche*, Torino, No. 146:25–29, Feb. **1955.** diagrs., tables. **DA**—Statistical material is presented, showing an increase in hail-control activities (1954 compared to 1953) in terms of 1) number of regional units participating, 2) number of communities, 3) launching units, 4) actual operations, 5) rockets launched and 6) cost. Rockets containing silver iodide were used besides the conventional explosive rockets. No direct indication is given of the results achieved. (*Same item as* 6J–326, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Hail prevention in Italy 2. Hail shooting 3. Torino Province, Italy.**—*G.T.*

**11M–633** 551.509.6:551.515.1

Petterssen, Sverre, (*Univ. of Chicago*), **On the magnitude of cyclone development and the possibility of large-scale modifications.** *National Academy of Sciences, Wash., D. C., Proceedings*, 41(11): 815–819, Nov. 15, **1955.** 9 refs., eq. **DWB**—An equation, developed by the author, showing the relation of cyclone development to vorticity, thermal advection, lapse rates, vertical velocity and supplied heat is used to illustrate that cloud seeding can produce only minor changes in a cyclone.

Relation to numerical forecasts is briefly discussed. (*Same item as* 9.7–144, July 1958, *Met. Abs.*) *Subject Headings:* **1. Cyclone development 2. Cloud seeding effects on cyclogenesis.**—*A.A.*

**11M–634** 551.509.617:551.578.7(45)

Pizzi, Giovanni, **Consuntivo della esperimentazione antigrandine 1951 in Provincia di Vicenza.** [Summary of hail control experiments in 1951 in Vicenza Province.] *Vicenza, Italy. Camera di Commercio, Industria e Agricoltura, Notiziario Economico,* 7(1):8–9, Jan. 1, **1952.** Also his: **L'esperimentazione antigrandine della Provincia de Vicenza nel 1952.** [Hail control experiments in Vicenza Province in 1952.] *Ibid.,* 7(12):15–16, June 16, **1952.** Also his: **La difesa antigrandine in Provincia di Vicenza nel suo 5° anno di esperimentazione: primi resultati.** [Hail control in Vicenza Province in its 5th year of experimenting: first results.] *Ibid.,* 9(10):7, May 16, **1954.** Also his: **La difesa antigrandine in Provincia di Vicenza al 6° anno di esperimentazione.** [Hail control in Vicenza Province in its 6th year of experimenting.] *Ibid.,* 10(8):1–2, April 16, **1955.** photo. **DA**—These reports cover the administrative and financial aspects of hail control activities in Vicenza Province. In 1951 an area of 20,500 ha was protected by 249 launching stations. In 1954 an area of over 34,000 ha was protected by 420 launching stations. The first qualitative results of the 5th year of operation (May 3, 4, 1954) were found satisfactory by visual observation. At the beginning of the 6th year of operation the protected area is 35,000 ha, with 438 launching sites. The cost since 1950 varied between 218 and 634 lire per ha and season. The rockets act by explosion between 1000 and 1500 m. The author maintains that this mechanical method provides effective protection from hailstorms, especially those connected with local thunderstorms. A photograph showing a rocket shortly after take-off is presented. (*Same item as* 6J–327, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Hail prevention in Italy 2. Hail shooting 3. Vicenza Province, Italy.**—*G.T.*

**11M–635** 551.509.617(512.317)

Portugal. Serviço Meteorológico Nacional, **Experiências de estimulação artificial de precipitação realizadas em Hongkong em Maio e Junho de 1955.** [Rainmaking experiments made in Hong Kong in May and June 1955.] Its *Memorias,* RT 240 MEM 66, Sept. 17, **1955.** 2 p. **DWB**—Describes cloud seeding operations during seven-week period May–June 1955 in Hong Kong. A total of 90,000 gal of water were sprayed into clouds from the ground at three locations along the windward slope 90 ft below the Victoria Peak—Mount Gough ridge. Results were observed by 60 gages measuring daily, 10 gages measuring hourly, visual cloud observers, and radar. According to C. S. Ramage (Dir. of the Royal Obs., Hong Kong), the experiment did not produce increased precipitation. As the use of dry ice or silver iodide is not practical in Hong Kong it does not appear to be possible to augment the rainfall of that region by artificial means. (*Same item as* 6J 363, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with water 2. Cloud seeding in Hong Kong 3. Hong Kong.**—*G.T.*

**11M–636** 551.509.617:551.577.52(512.317)

Ramage, C. S. and Bell, G. J., **Artificial and orographic stimulation of rainfall in Hong Kong.** *Hong Kong. Royal Observatory, Technical Notes,* No. 13, Oct. **1955.** 8 p. 6 figs., 9 refs. **DWB**—Seeding of clouds with dry ice and AgI is discussed and water seeding by spray intrained into base of cloud from ground, spraying equipment on hills near Hong Kong, is evaluated. It was concluded that water spraying at Hong Kong did not augment rainfall appreciably during period tested (May 1955). Sixty-six gages, of which 11 were automatic, were read once or twice a day. Detailed isohyetal maps of region show comparison between summer, winter and seeding day rainfall in relation to topography. Rough topography is thought to have 10 times the effect that seeding would have on rain stimulation. (*Same item as* 8.6–169, June 1957, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Cloud seeding with water 3. Orographic rainfall 4. Hong Kong.**—*M.R.*

**11M–637** 551.509.617(54)

Ramanathan, K. R. (*Physical Research Lab., Ahmedabad*), **Organization required for planned experiments on artificial rainfall in India.** (In: Symposium on artificial rain, New Delhi, Feb. 1953, **Proceedings and Papers.** pub. **1955.** p. 127–128.) **DWB**—Requirements for a research unit to study cloud seeding are outlined. Assistance from the Indian Air Force in cooperation with the Meteorological Department and a statistician, and with bases at Jodhpur, Ranchi and Hyderabad are suggested. Laboratory work in universities should also be conducted. (*Same item as* 9.4–113, April 1958, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding research 2. India.**—*M.R.*

**11M–638** 551.509.617

Ramdas, L. A. (*Met. Office, Poona*), **Methods of testing the efficacy of experiments on artificial rain-making.** (In: Symposium on Artificial Rain, New Delhi, Feb. 1953, **Proceedings and Papers.** pub. **1955.** p. 88–91. table, 3 refs.) **DWB**—Large scale field (ground, air and rain gage) experiments and detailed laboratory work must be conducted if proper evaluation of cloud seeding results

is to be performed. Both cloud physicists and statisticians should take part in the program. Regular interval seeding to see if a periodicity is set up, or random selection of ½ of clouds selected to seed and ½ not to seed, are two ways of getting objective information on efficacy of seeding. (*Same item as* 9.8–147, Aug. 1958, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding potentialities 2. Cloud seeding evaluation 3. Cloud seeding experiments.**—*M.R.*

**11M–639** 551.509.617(547.1)

Rao, Y. P. and Desai, B. N. (*Regional Met. Centre, Colaba, Bombay*), **Possibilities of artificial rain in the states of Bombay, Saurashtra and Kutch.** (In: Symposium on Artificial Rain, New Delhi, Feb. 1953, [**Proceedings and Papers.**] pub. **1955.** p. 121 126. fig., 2 tables.) **DWB**—The nature of clouds, their frequency and heights of bases and tops in the States of Bombay, Saurashtra and Kutch are discussed, particularly in the light of radiosonde data during the southwest monsoon period when cloudiness is maximum. On the basis of these data, the possibilities of artificially stimulating rainfall from such clouds or augmenting the amount of rainfall that might have been released by natural processes have been considered. In the Deccan and the Western Ghats, clouds suitable for seeding experiments are not infrequent in the monsoon and pre- and post-monsoon periods and there is a possibility of additional rainfall through seeding. In the Konkan, Saurashtra, Gujarat and Kutch, clouds which are considered suitable for seeding generally give rainfall naturally, and there does not seem to be much prospect of appreciably increasing this rainfall by seedings. (*Same item as* 8.4 145, April 1957, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding 2. Cloud frequencies 3. Cloud height 4. India.**—*Author's abstract.*

**11M–640** 551.509.617(54)

Roy, A. K. (*Met. Office, New Delhi*), **Experiments on precipitation control and evaluation of their results.** (In: Symposium on Artificial Rain, New Delhi, Feb. 1953, **Proceedings and Papers.** pub. **1955.** p. 78 87. 5 refs.) **DWB**—Conditions necessary for rain to occur, the seeding of cold clouds, warm clouds and evaluation of results of seeding in India and abroad are discussed with a view towards an understanding of the complexity of the problem which has been over-simplified by many. In the case of the Calcutta experiments (BANERJI and MUKHERJI, 1955) the fact that during the monsoon season natural rain occurs on 96% of the days within 50 mi of Calcutta is pertinent but was overlooked in evaluation of the results. (*Same item as* 9.8–148, Aug. 1958, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding experiments 2. Cloud seeding evaluation 3. Calcutta, India.**—*M.R.*

**11M–641** 551.509.617(54)

†Roy, A. K., **Rain-making: its present position and future possibilities.** New Delhi, Council of Scientific and Industrial Research, **1955.** 31 p. 9 figs. (incl. photos), 60 refs.—An objective report and evaluation of progress in artificial control of clouds and precipitation during the past decade, and of knowledge of cloud physics gained during the past two decades in various countries. The report discusses: rain formation in clouds, rain making in supercooled clouds, in warm clouds, need for rigorous tests of results of experiments, and limitations of known techniques. Diagrams show in great detail structure of natural rain cloud, of warm cloud with precipitation induced by injecting water or salt in base, of cold cloud in the Ganges area where seeding would be successful, and unsuccessful, respectively and an intermediate type (weak updraft but plenty of moisture) where precipitation would fall but be inconsequential. (*Same item as* 7.10–113, Oct. 1956, *Met. Abs.*) *Subject Headingss:* **1. Artificial precipitation reports 2. Cloud seeding in India I. Ramanathan, K. R.**—*M.R.*

**11M–642** 551.509.617:551.578.7:551.507.362.1

Ruby, Frederick-Leon, **Improved rocket or bomb for the prevention of hail.** (Photostat of trans. into English of original French.) *France. Patent Office, Patent* No. 1,010,878, Supplement (UNCL Patent No. 61,460). Main patent dated Feb. 6, 1950; applied for March 6, 1951, 15 h at Lyons; recorded Nov. 17, 1954; published May 4, **1955.** 3 p. **DWB** (M78.7 R8979im)—A patent is described which adds to the nucleating power of silver iodide by the force of the explosion which congeals a large portion of the supercooled droplets in the cloud, thus making them unavailable for growth into hail. Also the patent involves an improvement in the ordinary "rain-producing" aspects of the rockets or bombs, by incorporating a radioactive product in the smoke powder, shell, etc., making the air around ionized and a better conductor and suppressing the electric charges which tend to repel the droplets from one another. (*Same item as* 10.10–185, Oct. 1959, *Met. Abs.*) *Subject Headings:* **1. Hail rockets 2. Artificial precipitation patents 3. Silver iodide bomb.**—*M.R.*

**11M–643** 551.574.1:551.596.1:551.509.617

Sänger, Raymund and Spring, Fritz (*Zurich*), **Durchgang von Explosionswellen durch unterkühlte Wolken.** [Penetration of explosive waves through supercooled clouds.] *Zeitschrift für Angewandte Mathematik und Physik,* 6(1):75–76, Jan. 25, **1955.** English summary p. 76. **DLC**—

In connection with experiments with rocket borne explosives for hail suppression, clouds with temperatures of −18°, −19°, −14° and −19°C, respectively, were probed to see if any effect was produced by the explosive wave passing through the supercooled cloud. Results were negative, i.e., no effect was detected. (*Same item as* 6F–357, June 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud physics 2. Hail rockets 3. Cloud modification experiments 4. Switzerland.**—*M.R.*

**11M–644** 551.574.1:551.509.617(08)

Sänger, R., **International Symposium on Experimental Meteorology, Zürich 4. bis 6. Oktober 1954. Opening address.** *Archiv für Meteorologie, Geophysik und Bioklimatologie, Ser. A*, 8(3): 145–146, **1955. DWB**—A test in Switzerland showed that rockets were completely ineffective for inhibiting hail. A symposium on artificial influencing of weather processes was organized and the papers presented are given in this volume. (*Same item as* 6J 331, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Hail prevention in Switzerland 2. Cloud seeding research 3. Hail shooting 4. Symposia.**—*C.E.P.B.*

**11M–645** 551.509.617(676.1)

Sansom, H. W.; Bargman, D. J. and England, G., **Report on experiments on artificial stimulation of rainfall at Mityana, Uganda, September–December, 1954.** *East Africa High Commission. Meteorological Dept., Memoirs*, 3(4), **1955.** 6 p. 4 figs., 4 refs. Price: Sh. 3. **DWB, DLC**—Experiments were conducted by the East African Meteorological Dept. from Sept. to Dec. 1954 in Uganda by means of salt dispersal (balloon bomb technique). The results are evaluated by comparing rainfall amounts on seeding days (selected randomly) with amounts on control days, the former showing considerably higher amounts. Out of 33 clouds seeded, 24 yielded precipitation. (*Same item as* 8.6–171, June 1957, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in East Africa 2. Cloud seeding with salt 3. Balloon bomb techniques 4. Cloud seeding evaluation 5. Mityana, Uganda.** —*G.T.*

**11M–646** 551.509.617:551.578.7(494)

Santomauro, Luigi, **Considerazioni meteorologiche sulla lotta contro la grandine.** [Meteorological aspects of hail control.] *Bullettino dell'Agricoltura*, Milano, 89(26):1–2, July 1, **1955.** 12 refs. **DA**—Structure and dynamics of thunderstorm cells, distribution of thunderstorm precipitation, thunderstorm electricity, and the movement of thunderstorms are discussed. Hail control activities in Switzerland and in France and French North Africa are reviewed. The author refutes RUBY'S theory of artificial nucleation of thunderclouds by means of silver iodide rockets; RUBY'S theory is based on the assumption of a closed circulatory system within thunderstorm cells, whereas in reality thunderstorm cells are open thermodynamic systems. RUBY also fails to recognize the fact that downdrafts always prevail in the central areas of intense hailfall. Other cloud seeding techniques are also found inadequate for purposes of hail prevention. (*Same item as* 6J–365, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Hail prevention in Switzerland 2. Hail prevention in France 3. Silver iodide rockets.**—*G.T.*

**11M–647** 551.515.4:551.509.6:632.187

Schaefer, Vincent J., **Jet streams, thunderstorms and Project Skyfire.** *Archiv für Meteorologie, Geophysik und Bioklimatologie, Ser. A*, 8(3):265–282, **1955.** 7 figs., 14 refs. English, German and French summaries p. 265. **DWB.** Also condensed version as **Gewitter, Strahlströme und "Skyfire"-Projekt.** *Annalen der Meteorologie*, 7(1/2):149–151, **1955/56. DWB**—Project Skyfire aims at discovering new facts about thunderstorms and jet streams, especially in connection with forest fires, more than 70% of which are caused by lightning. The cloud survey from 25 mountain summits in Idaho and Montana is described. Besides thunderstorms, the relations of high clouds to the presence of a jet stream, the velocities of high clouds, and the height of cumulus bases were studied. The 1953 program was exploratory. In 1954 a mobile weather observatory was introduced. The possibility of cloud seeding to prevent or modify thunderstorms is discussed. (*Same item as* 6J–332, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Jet stream clouds 2. Thunderclouds 3. Forest fire control 4. Project Skyfire.**—*C.E.P.B.*

**11M–648** 551.574.1:551.508.94

Shimada, T.; Sekihara, K. and Kawamura, K. (*Met. Research Insl.*), **An effect of ultraviolet radiation on the action of silver iodide particles as sublimation nuclei.** *Meteorological Society of Japan, Tokyo, Journal*, Ser. 2, 33(6):276–279, Dec. **1955.** 6 figs., 3 tables, 5 refs., 2 eqs. In Japanese; English summary p. 276. **DWB, DLC**—The inactivation of ultraviolet ray on silver iodide as a sublimation nuclei was examined experimentally, using natural (solar) and artificial (mercury arc) light sources. The silver iodide particles produced at the temperature of 600–700°C were introduced into the diffusing boxes which were equipped with three different kinds of filter, i.e., cutting off the light of wavelength shorter than about $\lambda - 240$ m$\mu$, $\lambda - 345$ m$\mu$ and $\lambda - 415$ m$\mu$, respec-

tively. Then they were irradiated by ultraviolet ray of natural or artificial source. In order to examine the nucleating properties of silver iodide particles, a small part of them was sampled by a syringe at proper time intervals and then injected into the cold box at the temperature of $-14\sim-16$°C. Then the number of ice crystals formed in the cold box was counted by visual observation. The logarithm of counted number was plotted against time (minutes) and the decay constant was determined graphically from the slope. On the other hand, the effective energy distribution of ultraviolet radiation which actually exerted on the silver iodide particles in each diffusing boxes was computed, using the properties of filter transmissions and the light source. Thus the decay constant for the light of unit energy in different ranges of wave length was finally determined. According to these results, the efficiency of inactivation became better, as the wave length of ultraviolet ray irradiated became shorter. But in the case of solar radiation the intensity of radiation shorter than $\lambda - 350$ m$\mu$ was so weak that the actual effect was almost due to the longer side of the radiation. The rate of decay was about 1/500 per hour when irradiated through the cellophane-filter by natural light on a clear day. (*Same item as* 9.10–229, Oct. 1958, *Met. Abs.*) *Subject Headings:* **1. Nuclei effectiveness 2. Cloud chamber studies of nuclei 3. Ultraviolet light effects on nuclei.**—*Author's abstract.*

**11M–649** 551.509.617(76)

Shope, Harlan D., **Progress report on "Producing rain by cloud seeding."** *Paper Trade Journal* N. Y., 139(27):23, July 4, **1955. DLC**—Reports on cloud seeding operations in various areas of the southern U. S. by Howell Associates under contract with International Paper Co. Qualitative results of the operations are indicated. (*Same item as* 6J–333, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Southern U. S.**—*G.T.*

**11M–650** 551.509.617

Sigmund, H., **Über die Möglichkeit und den Wert der künstlichen Auslösung von Niederschlägen.** [Possibility and value of artificial production of rain.] *Wetter und Leben*, Vienna, 7(1/2):1–12, **1955.** 2 figs., 4 tables, 6 refs. **DWB**—After summarizing the 1954 WMO report on "artificial inducement of precipitation," the author analyzes the agricultural value of artificially induced rainfall on the basis of the drought period prevailing in Vienna in April 1952, July 1952 and April to Oct. 1947. It is assumed that cloud seeding could increase the daily rainfall by 1 mm. The synoptic conditions during the drought period and the advantages of cloud seeding during each are analyzed. (*Same item as* 6J–334, Oct. 1955, *Met. Abs.*) *Subject Heading:* **1. Artificial precipitation.**—*I.L.D.*

**11M–651** 551.574.2:546.57:546.15

Smith, E. J.; Heffernan, K. J. and Seely, B. K., **The decay of ice-nucleating properties of silver iodide in the atmosphere.** *Journal of Meteorology*, Boston, 12(4):379–385, Aug. **1955.** 2 figs., 2 tables, 9 refs. **DLC**—Finely divided zinc sulfide and freezing nuclei in the form of silver-iodide smoke were released from separate generators at the same time from the same position on the ground. Both were detected simultaneously at distances up to 56 km downwind from the respective generators, by apparatus installed in an aircraft. The comparative concentration was used as a measure of deterioration in the ice-nucleating properties of silver iodide. The total number of freezing nuclei, effective at $-17$°C, in silver-iodide smoke from a hydrogen burner, decreased by a factor of ten after eight minutes of exposure in the free atmosphere. The corresponding time with use of a kerosene burner was 50 minutes. The rate of decrease in the number of freezing nuclei was not influenced by the cloud cover. (*Same item as* 6I–141, Sept. 1955, *Met. Abs.*) *Subject Headings:* **1. Zinc sulfide nuclei 2. Ice nuclei 3. Silver iodide nuclei 4. Nuclei and wind 5. Nuclei and clouds.**—*Authors' abstract.*

**11M–652** 551.509.617:551.574.1

Sohoni, V. V. (*Dir. General of Observatories, New Delhi*), **Introductory address (to Symposium on Artificial Rain, New Delhi, Feb. 1953).** (In Symposium on Artificial Rain, New Delhi, Feb. 1953, **Proceedings and Papers.** pub. **1955.** p. 1–15.) **DWB**—A thorough review of progress in rain making, cloud physics and cloud seeding from literature published since 1889, and including recent work in Australia, India and elsewhere. The ice crystal theory and the warm cloud investigations are given special consideration. *Subject Headings:* **1. Artificial precipitation 2. Cloud seeding 3. Cloud physics.**—*M.R.*

**11M–653** 551.574.2:546.57:546.15

Soulage, Guy, **Étude de générateurs de fumées d'iodure d'argent.** [Study of silver iodide smoke generators.] *Puy-de-Dôme. Observatoire, Bulletin*, Ser. 2, No. 1:1–8, Jan./March **1955.** 5 figs., 6 refs. French and English summaries p. 1. **DWB**—The combustion of silver iodide impregnated charcoal (1.5% silver iodide) without forced ventilation produces $10^{14}$ nuclei active at

−20°C; only 1% among these nuclei are found active at −10°C. The scattering of the time values between the moment at which the nuclei go into a cloud at temperature below 4°C and the moment at which they act as ice-forming nuclei is supposed to be very important for the experiments of cloud modification. The number of ice-forming nuclei produced by charcoal generator decreases with the silver iodide concentration in charcoal and increases with the ventilation of the fire. (*Same item as* 6I–143, Sept. 1955, *Met. Abs.*) *Subject Headings:* **1. Artificial nuclei production 2. Silver iodide nuclei 3. Ice nuclei.**—*Authors' abstract.*

**11M–654** 551.509.617

Spar, Jerome (*Dept. of Met., N. Y. Univ.*), **Weather control experiment in the Eastern United States.** *New York Academy of Sciences, Transactions,* Ser. 2, 17(8):621–626, June **1955.** table. **DLC**—Scientific results achieved under Project SCUD (New York Univ.) are reported. The purpose of the project was "to determine the effects of artificial cloud nucleation on cyclogenesis off the east coast of the U. S." During the periods Jan.–April 1953 and Dec. 1953–April 1954 extensive cloud seeding operations were carried out both from the air (dry ice) and from the ground (AgI). A careful statistical analysis of precipitation and pressure data does not show any effect exceeding natural meteorological variance. (*Same item as* 6J–335, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Eastern U. S. 2. Project SCUD (New York Univ.).**—*G.T.*

**11M–655** 551.577.1

Squires, P., **Project "Shower": an investigation on warm rain in the Hawaiian Islands.** *Nature,* London, 175(4461):748–750, April 30, **1955.** fig. **DWB**—Account of a full air and ground investigation of rainfall at Hawaii which forms entirely above freezing point. The branch of the trade which crosses the saddle between Mauna Kea and Mauna Loa was studied in detail, including raindrop spectra, salt content, liquid water, etc. A great mass of information was collected for future publication. (*Same item as* 6F–360, June 1955, *Met. Abs.*) *Subject Headings:* **1. Rain from nonfreezing clouds 2. Project "Shower" 3. Hawaii.**—*C.E.P.B.*

**11M–656** 551.574.1:551.509.617

Stimson, Thomas E., Jr., **Let's import rain for the Dust Bowl.** *Popular Mechanics Magazine,* 103(1):119–123, 234, 236, Jan. **1955.** figs., photos. **DLC**—Cloud physics studies conducted at the New Mexico Institute of Mining and Technology under J. WORKMAN are discussed. The "cloud tube" used for simulating various cloud conditions is described and illustrated. Particular attention is paid to the discovery of the generation of thunderstorm electricity by phase transitions of cloud droplets, and a possible modification of this process by seeding with ammonia. The idea of a long-range effect of cloud seeding operations is also discussed. (*Same item as* 6J–336, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud physics research 2. Thunderstorm electricity generation 3. Cloud seeding with ammonia.**—*G.T.*

**11M–657** 551.509.617:551.578.7(494.5)

*Switzerland. Eidg. Kommission zum Studium der Hagelbildung und der Hagelabwehr, **Grossversuch II zur Bekämpfung des Hagels auf der Magadinoebene. 1. Versuchsjahr.** [Project II for Hail Control in the Magadino Plain. 1st year of experiment.] Its *Tätigkeitsbericht,* No. 6, 1953, pub. by Eidg. Volkswirtschaftsdepartement. Abteilung für Landwirtschaft, Bern, **1954.** 46 p. 19 figs., 40 tables. Also: . . . **2. Versuchsjahr . . .** [2nd year of experiment.] *Ibid.,* No. 7, 1954. publ. **1955.** 41 p. 12 figs., 41 tables. **DWB**—Progress Report No. 6 is the first on the new hail control project in the Magadino Plain, in which rockets were replaced by ground-based AgI generators. A very comprehensive description of the seeding network and of each operation is given, with detailed data and charts. Despite the painstaking observation and evaluation efforts no definite conclusions could be reached, due to the small number of thunderstorms during the summer of 1953. Progress Report No. 7 gives an equally detailed description of the 1954 operations and their results, which are again termed inconclusive because of the paucity of hailstorm cases. In the second year automatic generators were used instead of hand-operated units; thus the operation time could be prolonged. As a side study the project comprised tracing of AgI particles in rain water from seeded storms and electron-microscope study of such particles. The project is to be continued. (For later reports *see* 11M–749, 830, –897, –960 and 1011). (*Same item as* 6J–338, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Hail prevention in Switzerland 2. Cloud seeding with silver iodide 3. Magadino Plain, Switzerland.**—*G.T.*

**11M–658** 551.509.617:08

†Symposium on Artificial Rain, New Delhi, Feb. 1953, **[Proceedings and papers] of Symposium held under joint auspices of Atmospheric Research Committee, CSIR and India Meteorological Dept.** New Delhi, Council of Scientific and Industrial Research, **1955.** 148 p. figs., tables, foot-refs., bibliogs. **Selective bibliography on artificial rain,** taken from *MAB,* Vol. 1, No. 3, 1950,

and other sources, p. 135–148 (187 items). **DWB.** Review by K. R. S. in *Science and Culture*, Calcutta, 22(3):185–186, Sept. **1956. DLC**—At this symposium, held on Feb. 9 and 10, 1953, in the Meteorological Offices, New Delhi, under the chairmanship of the Director, V. V. Sohoni, 20 papers were presented and discussed. It was concluded that: 1) results of seeding attempts to date were inconclusive, 2) the most favorable conditions for successful seeding would be found in regions where natural precipitation is most likely and 3) neither $CO_2$, AgI or $H_2O$ (warm cloud) seeding had yet produced effective increase in precipitation in arid regions or drought areas. Further study was deemed vital, both in controlled experiments and in methods of evaluating. Twelve of the 20 papers are printed in full, 8 in abstract form. (For listing of complete papers, *see* 8(1):137, Jan. 1957, *Met. Abs.*) (*Same item as* 8.1–3, Jan. 1957, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation symposia 2. Weather control bibliographies 3. New Delhi, India.**—*M.R.*

**11M–659** 551.509.6:016

†Thuronyi, Geza, **Annotated bibliography on weather modification.** *Meteorological Abstracts and Bibliography*, Boston, 6(10):1433–1513, Oct. **1955.** 365 annotated items, including two separate listings of 77 and 128 titles (unannotated). **DWB**—An attempt was made in this bibliography to supplement the **Bibliography on Cloud Physics and Artificial Precipitation,** Vol. 1, No. 3, March 1950, *Met. Abs.*, with articles primarily concerned with the practical aspects of cloud seeding, operational "rain making" or weather modification. The bibliography contains over 550 items, 365 of which include abstracts. The unannotated items comprise 77 papers prepared by Dr. I. P. Krick and collaborators, and 128 miscellaneous contributions partly from earlier issues of *Met. Abs.*, partly articles with self-explanatory titles or of purely local or regional interest. The material is indexed under the headings: general, history and development, cloud seeding equipment and techniques, miscellaneous methods and techniques, properties and effectiveness of cloud seeding agents, projects and operations, evaluation methods, and effects and application of cloud seeding. A geographic outline of contents is added. Most of the material has been incorporated into the present bibliography. *Subject Headings:* **1. Weather modification bibliographies 2. Cloud physics bibliographies.** —*O.T.*

**11M–660** 551.509.617(794)

Todd, Clement J. (*Project meteorologist*) and Battle, John A. (*Vice pres.*), **Cloudseeding operations in the Santa Ana River watershed for the period November 1, 1954 to April 15, 1955.** Redlands, Calif., Weather Modification Company, [**1955**]. 34 p. photos., maps. **DWB**—In this report over a dozen seeded storms are described and shown on maps representing synoptic development, generators operated and rainfall areas. The effect of seeding was observed by radar (radarscope photographs presented) which made detailed observation of rainfall areas possible. It was found that many areas were left unaffected, which leads to the conclusion that a larger number of generators of a new type should be used. From the data available it is estimated that an average 20% precipitation increase was achieved in these operations. (*Same item as* 6J–339, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in California 2. Cloud seeding evaluation 3. Radar analysis of rain 4. Santa Ana river, Calif. I. Weather Modification Company, Redlands, Calif.**—*G.T.*

**11M–661** 551.509.617:546.57:546.15(52)

§Tohoku, Japan. Electric Power Company, **Report of artificial rain-making, No. 7, July 1954; No. 8, Nov. 1954; No. 9, June 1955, and No. 10, Oct. 1955.** 54, 48, 33 and 79 p., respectively. Numerous figs., tables and charts (many fold.).—This series of reports on silver iodide seeding in the Tohoku District of Northern Honshu, contains further and more detailed results of the carefully controlled experiments with a dense and systematic network of seeding, target and control stations in that area than were contained in the **"Report on rain-making in Japan,"** Vol. 1, 1954 (*see* 11M–574). Complete details of the meteorological and technological aspects of each of a dozen cases of seeding in Jan.–March 1954, are accompanied by synoptic charts (surface, 850 mb and 700 mb) and isohyetal charts of the area showing actual amounts of rainfall at each station and seeding details. Statistical analyses of each case are also presented graphically and discussed, and totals for period are compared with control areas and with non-seeding days when storm conditions were similar. Issue No. 8 contains 24 such case-history charts and analyses for July–Sept. 1954, No. 9 gives a thorough statistical analysis of all AgI ground seeding tests during July–Dec. 1954, and No. 10 gives an even more detailed analysis of control-target, seeding-non-seeding days for Jan.–March 1955. (*Same item as* 8.7–142, July 1957, *Met. Abs.*) *Subject Headings:* **1. Silver iodide seeding tests 2. Tohoku District, Japan.**—*M.R.*

**11M–662** 551.579:63

†U. S. Dept. of Agriculture, **Water: the Yearbook of Agriculture, 1955.** Wash., D. C., Govt. Print. Off., **1955.** 751 p. figs., tables and bibliogs. throughout. General bibliog. p. 722–723. **DA, DLC**—This yearbook is devoted to a survey of the properties, behavior and conservation of water.

The emphasis is upon the role of water in the various aspects of agriculture. The subjects treated are as follows: the needs and use of water by plants, animals and man; the source of water including the water cycle, waters in rivers and oceans, artificial precipitation (*see* 11M-605), fog, mist and dew, precipitation variations, etc.; the interaction of water and soil; the relationship between water and forests; the use of water in irrigation; the role of water in crop production; water and ranges and pastures; drainage of fields; the relationship between water and wild life; and legislative regulations of water use; water conservation, etc. The volume contains numerous diagrams and photographs, quantitative data and bibliographic citations. (*Same item as* 7.3–4, March 1956, *Met. Abs.*) *Subject Headings:* **1. Agricultural hydrology 2. Water resources.**—*I.L.D.*

**11M–663** 551.509.617:016

†U. S. Weather Bureau, **A short bibliography on artificial production of precipitation.** Its *L.S.* 5507, Revised Aug. 1, 1955. 8 p. **DWB**—A careful and competent selection of literature on cloud seeding. The bibliography is entirely up to date and covers papers written in English, most of them published since 1949. The reference (author, title, source) are given in the following subject arrangement: A. Fundamental papers (4 items), B. Historical (5), C. Legal aspects (6), D. U. S. Government experiments and evaluations (7), E. Other experiments and evaluations (31) and F. Theoretical discussions (29). (*Same item as* 6J–341, Oct. 1955, *Met. Abs.*) *Subject Heading:* **1. Weather modification bibliographies.**—*G.T.*

**11M–664** 551.509.617

Verna, Antonio, **Pioggie artificiali: raccolto assicurato; . . . fino a quando?** [Artificial rain: crop assured—until when?] *Selezione di Tecnica Molitoria* (*Pastificazione, Panificazione*), Pinerolo, 6(3):41–42, March 1955. **DA**—Warns of dangers of indiscriminate cloud seeding which would upset the natural balance of weather development and (in Langmuir's words) "could lead to climatic disasters capable of transforming the entire globe into an immense desert." (*Same item as* 6J–342, Oct. 1955, *Met. Abs.*) *Subject Heading:* **1. Artificial precipitation.**—*G.T.*

**11M–665** 551.509.617(794)

Vernon, Edward M. (*U. S. W. B., San Francisco Airport*), **Report on classification of storms for statistical evaluation with special reference to Carrizo plain and Santa Maria coastal areas.** Feb., May and Oct. 1953. *California. State Water Resources Board, Bulletin*, No. 16: 163–193, June 1955. figs. (fold.), table, 10 refs. **DWB**—This report contains an outline of a method of precipitation classification by pressure and flow pattern types. The types are selected according to their favoring precipitation amounts in one (target) or the other (control) area considered. The method is worked out for various regions in California, with applicability to the evaluation of cloud seeding operations there. (For fuller abstract, *see* 6.6–140, June 1955, *MAB.*) (*Same item as* 6J–343, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Precipitation classification 2. Synoptic classification of precipitation 3. Cloud seeding evaluation 4. California.**—*G.T.*

**11M–666** 551.509.6

von Neumann, John (*Atomic Energy Commission*), **Can we survive technology?** *Fortune*, N. Y., 51(6):106–108, 151–152, June 1955. port. **DLC**—In an article on technological developments by 1980, among other things, the author discusses the possibility of large scale weather control becoming effective during the next 25 years. If such control is attained for peaceful purposes, it may also be used for offensive purposes—such is the history of all new technological developments. Rain making, changing the amount of effective incoming solar radiation by changing the delicate balance of chemical elements in upper atmosphere ($CO_2$, $O_3$ for instance), or by changing albedo of snow or glacier surfaces, etc. are examples of types of climate control possible in the next generation. (*Same item as* 6J–344, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Weather control 2. Technological advances.**—*M.R.*

**11M–667** 551.574.2:551.509.617:629.135

Warren, D. R. and Nesbitt, M. V., **An airborne silver iodide dispensing burner.** *Melbourne, Australia. Aeronautical Research Laboratories, Mechanical Engineering Note*, No. 200, May 1955. 20 p. 17 figs. **DWB**—An analysis has been made of the combustion conditions giving maximum efficiency in the dispensing of silver iodide for rainmaking purposes. A burner has been designed which, with its fuel tank and control gear could be attached to commercial aircraft as a self-contained automatically-operated pod. It has been shown that the conventional use of kerosene or petrol to maintain combustion is unnecessary, and that the combustion of an acetone solution of AgI can be arranged to give equal efficiency in the production of active nuclei. A brief study of the kinetics of activity decay has shown that the rate of decay from four different dispensing systems is proportional to concentration to the power 1.5. This gives some support to the view that decay is due to

nuclear aggregation. (*Same item as* 8.7–266, July 1957, *Met. Abs.*) *Subject Heading:* **1. Air-borne AgI smoke generators.**—*Author's abstract.*

**11M–668** 551.585.53:06

†White, Gilbert F. (*ed.*), **The future of arid lands. Papers and recommendations from the International Arid Lands Meetings (Albuquerque, N. M., 1955).** *American Association for the Advancement of Science, Wash., D. C., Publication*, No. 43, **1956.** 464 p. 49 figs. (incl. photos), numerous bibliogs. Price: $6.75. Also: White, Gilbert F. and Duisberg, Peter C., **International Arid Lands Meetings in New Mexico,** *Science*, 121(3137):218–220, Feb. **1955.** Also: **International Arid Lands Meetings.** *Ibid.*, 121(3149):659–660, May 6, **1955.** Also: **Recommendations for development of arid lands (at the) International Arid Lands Conference.** *Ibid.*, 122(3148):61 64, July 8, **1955.** photo. **DWB**—The papers presented at the Conference include one by BOWEN on his theory of meteoric dust seeding, and others dealing with subjects relating to weather modification. It was recommended that the IGY program be extended to cover arid zone countries, that networks of stations and studies of solar relationships, weather modification, meteoric nuclei, etc., be considered. (For fuller abstracts *see* 7.6 220 and 8.4–5, *Met. Abs.*) *Subject Headings:* **1. Arid zone research 2. Conferences 3. Albuquerque, New Mexico.**

**11M–669** 551.509.617(795)

Woodbridge, David D. (*Dept. of Physics, Oregon State College, Corvalis*), **A storm analysis of the Tillamook Burn cloud-seeding operation.** *American Meteorological Society, Bulletin*, 36(1):22–26, Jan. **1955.** 3 figs., 3 tables, 7 refs. **DWB, DLC**—The method of storm analysis used to evaluate cloud seeding operations consists of the typing of frontal systems for all of Oregon on the basis of pressure distribution over Oregon and the Pacific "as a front enters a so-called critical area." For each type a definite percentage of "dry frontal passages" was found and from these values the probabilities for the occurrence of precipitation with each type of frontal passage are calculated. "Prevailing type storms were compared with similar storm types that passed through the Tillamook Burn area during the cloud seeding operation." (*Same item as* 6J–345, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Oregon 2. Oregon.**—*I.L.D.*

**11M–670** 551.509.616/7:551.574.1

World Meteorological Organization. Commission for Aerology, **Artificial control of clouds and hydrometeors.** Report of working group, prepared by L. Dufour, Ferguson Hall, F. H. Ludlam (chairman) and E. J. Smith. *World Meteorological Organization, WMO* [*Publication*], No. 50. TP. 19; *Technical Note*, No. 13, **1955.** 76 p. refs. French, Russian and Spanish summaries p. VII–XII. **DWB** (M(06) W927p). Also: **Artificial control of clouds and hydrometeors.** *World Meteorological Organization, WMO Bulletin*, 8(3):140–144, July **1959.** 18 refs. **DWB**—The authors of this report review the present state of knowledge concerning artificial modification of the structure and development of clouds and hydrometeors, with a view to evaluating the results of experiments made in various parts of the world. Pt. 1 is a general summary of cloud physics with particular attention to the processes of precipitation formation. In Pt. 2 the small-scale cloud modification experiments are described (orographic clouds, individual clouds, fog dispersal). Pt. 3 takes up large-scale weather modification experiments; the authors find that the question of large-scale effects cannot be answered satisfactorily after ten years of intensive cloud seeding, because operations were aimed at obtaining results rather than information. Pt. 4 contains the authors' conclusions to the effect that cloud seedings from airplanes have almost certainly produced results, that no marked increase in precipitation has been achieved so far and that several years of basic research and carefully prepared and analyzed experiments will be necessary in order to evaluate with certainty the economic potential of cloud seeding operations. Plans to revise *WMO Technical Note* No. 13 in the light of recent advances in cloud seeding and weather control are discussed, along with comments on these advances, in the article in *WMO Bulletin*. (*Same item as* 10.9–23, Sept. 1959, *Met. Abs.*) *Subject Headings:* **1. Artificial cloud modification 2. Cloud physics 3. Cloud seeding. I. Dufour, L. II. Hall, W. Ferguson III. Ludlam, F. H. IV. Smith, E. J.**—*G.T.*

**11M–671** 551.509.617(794)

**Cloud seeding.** *Shell Aviation News*, No. 205:12–13, July **1955.** Photos. **DLC**—Cloud seeding operations conducted by the California Electric Power Co. since 1948 in Owens Valley on the east slope of the Sierra Nevada Mountains are briefly outlined. Operations take place during the summer season from airplanes dispensing dry ice which has been found more effective than AgI under conditions prevailing in that region. Equipment and operations are described and illustrated. River flow in the area was augmented by 9% during the period 1948–1950. (*Same item as* 6J–356, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in California 2. Owens Valley, Calif.**—*G.T.*

11M–672 551.509.617

**[Control over the weather through artificial "seeding" of clouds.]** *Science*, 122(3163):278–279, Aug. 12, 1955. **DLC**—Reports results of ONR Operation SCUD as evaluated by J. TUKEY of the Forrestal Research Center, Princeton, N. J. "No evidence of any large-scale meteorological effects." Also announces Operation OVERSEED in which AgI generators will be operated at the foot of Mount Washington, N. H., in the fall of 1955. (*Same item as* 6J–299, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Weather control 2. Cloud seeding with silver iodide 3. Project SCUD (New York Univ.) 4. Operation OVERSEED. I. Tukey, J.**—*G.T.*

11M–673 551.509.617:523.5

**Hemispheric rain-making.** *Science News Letter*, Wash., D. C., 67(19):292, May 7, **1955. DLC**—Brief note on BOWEN'S well-known theory of meteoric dust being responsible for seeding clouds 30 days after entering atmosphere. AgI is thought to be ineffective if released from ground, but would be more effective if sprayed from airplanes or high mountain tops. (*Same item as* 6J–310, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Meteoric dust effect on rainfall 2. Cloud seeding.**—*M.R.*

11M–674 551.509.617

**†Internationales Symposion für experimentelle Meteorologie, Zürich 4. bis 6. Oktober 1954.** [International Symposium on Experimental Meteorology, Zurich, Oct. 4–6, 1954.] *Archiv für Meteorologie Geophysik und Bioklimatologie, Ser. A*, 8(3):145–318, **1955.** 72 figs., numerous refs. Also: Murgatroyd, R. J., **International Symposium on Experimental Meteorology, Zurich, October 4–6, 1954.** *Meteorological Magazine*, 83(990):374–375, Dec. **1954. DWB**—This issue of the **Archiv** contains the opening address and 14 of the 18 papers presented at an International Symposium in Zurich. The papers are substantial contributions to the fields of the physics of clouds and precipitation, condensation nuclei and weather modification. Those having a direct bearing on the last mentioned subject are being abstracted separately in the present bibliography (*see* 11M–586, –595, –623 and –625). In MURGATROYD'S review the lectures are briefly summarized. (*Same item as* 6J–312, Oct. 1955, *Met. Abs.*) *Subject Heading:* **1. Artificial precipitation symposia.**—*G.T.*

11M–675 551.509.617

**Less hail, more rain—on order?** *Farm Journal*, p. 27, 87, July **1955.** diagr. **DLC**—Review of the current rain-making situation: (a) successful large-scale cloud seeding operations in Georgia, Mississippi and Oklahoma, (b) continued hail suppression operations in California and Oregon by I. P. KRICK and (c) statement by H. C. THOM, chief climatologist for the Advisory Committee on Weather Control, regarding the development of statistical methods for evaluating results of cloud seeding. (*Same item as* 6J–318, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Weather control 2. Cloud seeding evaluation.**—*G.T.*

11M–676 551.509.617

**The most extensive cloud-seeding experiment.** *Science*, 121(3148):629, April 29, **1955. DWB**—Large-scale effects of cloud seeding with dry ice and silver iodide were found to be non-existent although small scale effects may have occurred during 9 months of trials on the East Coast of the U. S., Jan.–April 1953 and Dec. 1953–April 1954. Thirty tons of dry ice were dropped from airplanes between Mass. and Florida, and 250 lbs of AgI were sprayed from ground generators. Eighteen of 37 cases selected were seeded and 19 left as controls. "Project Scud" was conducted by New York Univ. College of Engineering. (*Same item as* 6J–324, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Eastern U. S. 2. Large-scale effects of cloud seeding 3. Project SCUD (New York Univ.) 4. Atlantic Coast, U. S.**—*M.R.*

11M–677 551.509.617(94)

**Rain-making experiments in Australia.** *Australian Sugar Journal*, Brisbane, 46(11):741–747, Feb. 15, **1955.** photos. **DLC**—Describes various cloud seeding methods. In Australia dry-ice seeding was definitely successful; AgI seeded from the air was found to require colder cloud-top temperatures for success; a ground-generator experiment carried out over a period of 3 months was inconclusive; seeding with water produced rain from nonfreezing clouds at least 5000 ft thick. As the techniques which showed success in Australia require the use of aircraft, their cost is prohibitive. Some less expensive methods will have to be developed. (*Same item as* 6J–328, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Australia 2. Cloud seeding techniques 3. Australia.**—*G.T.*

11M–678 551.509.617

**Rainmaking powers limited.** *Engineering News Record*, New York, 154(18):100, May 5, **1955. DLC**—Findings of two reports on weather modification research are briefly summed up: 1) New

York University reports on the basis of two years of research that storms cannot be controlled on a large scale. 2) According to the California State Division of Water Resources, cloud seeding some times increases, sometimes does not affect and sometimes decreases precipitation from storms depending on physical conditions not yet under control. (*Same item as* 6J–329, Oct. 1955, *Met Abs.*) *Subject Headings:* **1. Cloud seeding evaluation 2. Weather control.**—*G.T.*

**11M–679** 551.509.617

**Rain making succeeds in tropical clouds.** *Science News Letter*, 67(23):367, June 4, **1955. DLC**—Reports statement by HORACE R. BYERS on successful seeding of nonfreezing clouds with wate spray. Experiments sponsored by the U. S. Air Force were conducted over the open sea nea Puerto Rico and controlled by radar. Statistically significant positive results were obtained. (*Sam item as* 6J–330, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding evaluation 2. Clou seeding with water. I. Byers, Horace R.**—*G.T.*

**11M–680** 551.509.617:551.574.1(969)

**Regenmakers steken hun kop in de tropische wolken.** [Rainmakers stick their heads into th tropical clouds.] *Hemel en Dampkring*, The Hague, 53(8/9):170–171, Aug./Sept. **1955. DWB DLC**—Discusses BOWEN'S experiments of artificial precipitation to be conducted in the Hawaiia Islands and BOWEN'S theory of rain formation. (*Same item as* 8.6–170, June 1957, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Bowen's theory 3. Hawaiian Islands.**—*I.L.D.*

**11M–681** 551.509.61

**Suggest reverse of cloud seeding method.** *Science News Letter*, Wash., D. C., 67(20):319 May 14, **1955. DLC**—Rainfall may be increased by removing particles from the air in order t prevent natural overseeding. This was suggested, according to this brief note, by GLENN W. BRIE of the U. S. Weather Bureau to the International Arid Lands Meetings in Albuquerque, N. M (*Same item as* 6J–337, Oct. 1955, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Brier Glenn W.**—*G.T.*

## 1956

**11M–682** 551.576.11:551.555.1:551.577.11 551.509.617(729.5

Ackerman, Bernice, **Buoyancy and precipitation in tropical cumuli.** *Journal of Meteorology* 13(3):302–310, June **1956.** 11 figs., 4 tables, 9 refs. **DWB**—Observations were made by airplan in trade-wind cumuli around Puerto Rico of radar echoes of precipitation and virtual temperature Buoyancy was calculated from excess of cloud temperature over environment. Temperature i clouds varied on scales of 1000 and 100–200 ft. Subsequent echo history showed that precipitatio depended on excess of temperature, environmental humidity and wind shear. Scatter diagrams o echo *vs* no echo explain 87% of occurrences of rain. Formation of rain in upper parts of cloud wa accompanied by a decrease in cloud buoyancy. Individual cases are examined. Some clouds wer sprayed with water; heavy (but not light) spraying increased probability of precipitation whe buoyancy was not favorable for natural precipitation. (*Same item as* 7.10–227, Oct. 1956, *Met. Abs.* *Subject Headings:* **1. Precipitation from tropical cumuli 2. Cloud seeding with water 3. Trade win cumulus clouds 4. Puerto Rico.**—*C.E.P.B.*

**11M–683** 551.574.14:537.

Albani, Felix, (*Univ. Nac. de Cuyo et Servicio Meteorológico Nacional, Argentina*), **Sur l'actio glacogène de l'étincelle électrique sur les nuages surfondus.** [On the ice forming action of electri sparks on supercooled clouds.] *Puy de Dôme. Observatoire, Bulletin, Ser.* 2, No. 1:7–10, Jan. March **1956.** 7 refs. French, Spanish and English summaries p. 7. **DWB**—Ice crystals can b produced in the laboratory in a supercooled cloud, by sparks between electrodes made of aluminum silver, copper, nickel, lead, platinum or steel, but the greatest number are produced when silve electrodes are used. Nuclei are produced by the spark even at >0°C, and nucleation occurs a temperatures only slightly below 0°C. At least $10^8$–$10^7$ nuclei/min are produced at −5° to −7°C Conditions in the atmosphere are not identical with those in the laboratory since during a lightnin discharge there is no metallic electrode present. An attempt is made to differentiate between th nucleation caused by the sparks, by ozone or some other electrochemical product of the spark, o by products detached from the electrodes. (*Same item as* 8.11–210, Nov. 1957, *Met. Abs.*) *Subje Headings:* **1. Nucleation action of sparks 2. Silver electrode action on nucleation.**—*M.R.*

**11M–684** 551.509.616:551.576.1

Alexander, Rolf and Scorer, R. E., **The man who dissolved clouds: the biological aspect o meteorology.** *Weather*, 11(12):396–400, Dec. **1956.** 3 refs. **DWB**—ALEXANDER supposes "bio-physical field" in the atmosphere which propagates impulses from the human brain, impulse

which can dissolve clouds. Successful experiments are referred to (but not documented), and a protest is made about SCORER's attitude (*see* 11M–740). In his reply SCORER questions ALEXANDER'S theory and points out that he has produced no real evidence in support. (*Same item as* 8.4–268, April 1957, *Met. Abs.*) *Subject Heading:* **1. Artificial cloud dispersal.**—*C.E.P.B.*

**11M–685** 551.509.617(792)

Anderson, Clair Keith, **An evaluation of the effects of summer cloud seeding in southern Utah.** Salt Lake City, University of Utah, **1956.** 33 p. 6 figs., 4 tables, 9 refs. **DLC** (QC929.R1A55)—Evaluation of AgI seeding is presented in tabular and graphical form for tests conducted in central Utah in April 1951, through 1954, using control and target areas in Utah and adjacent portions of Colorado, Arizona, New Mexico, Nevada and Wyoming. Graph shows deviation in percent of normal of actual precipitation from computed precipitation for summer months from 1941–1954, inclusive. Conclusion is that there was an apparent increase of 10.36% of normal which would occur 7 times out of 100 by chance. Statistical evaluation is shown in detail in tables and on curves. (*Same item as* 10.7–177, July 1959, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding evaluation 2. Silver iodide seeding tests 3. Utah.**—*M.R.*

**11M–686** 551.509.616/617:627.8(52)

Asada, T. (*Faculty of Science, Osaka Univ.*), **Artificial rain-making in Kansai District.** *Papers in Meteorology and Geophysics*, Tokyo, 7(3):340–341, Oct. **1956. DWB**—The artificial rain making in Kansai region had statistically been proved to be effective through a series of tests carried out during the period from Sept. 1951 to Dec. 1953; particularly the experiment carried out by AgI smoke generation from the ground at Okinoshima Island during the winter of 1952–1953, which taught us that it could bring about precipitation increase by over 30% if it was made under proper meteorological conditions. Encouraged by the results of such test, we have taken up the resource zones for water power generation of Kansai Electric Power Company as our target area since the summer of 1953, with the aim to develop the rain making tests into commercial use and have installed at various power stations of said company, AgI smoke generators of the "Osaka type" electric heating evaporator while the exact time of smoking has been decided at the instruction of the weather station so that the artificial rainfall may directly serve to increase the generation of power besides obtaining experimental results. (*Same item as* 9.9–142, Sept. 1958, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Cloud seeding effectiveness 3. Cloud seeding for water power generation 4. Kansai District, Japan.**—*Author's abstract.*

**11M–687** 551.509.617:546.33(691)

Augustin, Henri (*Service Météorologique de Madagascar*), **Les recherches du Service Météorologique de Madagascar dans le domaine de la pluie provoquée de 1953 à 1956.** [Research by the Meteorological Service of Madagascar in the field of artificial precipitation from 1953 to 1956.] (In: Angola. Serviço Meteorológico, **Miscelanea geofísica.** Luanda, **1956.** p. 194–205. 3 figs., 2 tables, 3 refs. **DWB** (M(08) A592mi)—Visual and rain gage observations made during 101 days of cloud seeding experiments made on Madagascar by means of salt dispensed from aircraft are analyzed. The experiments, conducted in order to alleviate the disastrous local drought, are found to have produced some interesting results. It is not believed, however, that they could be expected to produce climatic changes of any importance. (*Same item as* 12.2–254, Feb. 1961, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding experiments 2. Cloud seeding with salt 3. Madagascar.**—*Transl. of author's abstract.*

**11M–688** 551.509.617(794)

Baum, Werner A.; Asplund, Stanley E.; Henry, Robert M.; Long, William H. and Rosenthal, Stanley L. (*all, Florida St. Univ.*), **Assessment of the effect of commercial cloud seeding in North Florida and South Georgia, 1955–1956.** *Florida Academy of Sciences, Gainesville, Quarterly Journal*, 19(2/3):104–120, June/Sept. **1956.** 5 figs., 3 tables, 8 refs. **DLC**—Carefully devised tests of cloud seeding (by means of AgI from ground generators) effectiveness during the large-scale seeding operations in North Florida from July 1, 1955–Jan. 1956, indicate that a high probability exists that a decrease in rainfall occurred in July–Aug. 1955 and an increase in Jan.–Feb. However, such summer decreases may be expected one year in ten and winter increases 4 years in ten, as a result of random variations. Regression curves on scatter diagrams show relation of target to control area precipitation figured according to 2 methods. Chances of specified increases or decreases, based on raw data, are given in tables. (*Same item as* 8.10–116, Oct. 1957, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with silver iodide 2. Cloud seeding effectiveness 3. North Florida.**—*M.R.*

**11M–689** 551.510.721:551.509.68:662.2:539.1

Bengelsdorf, Irving, **Can the atom change the weather?** *Saturday Review*, p. 31–36, July 7, **1956.** figs. **DLC**—The author takes exception with the general opinion (among meteorologists)

that the atom or H-bomb has not affected the weather. He bases his argument on LANGMUIR's idea of "divergent" phenomena or trigger action. Possible effects of atomic debris or radiation in triggering clouds, changing the electrical conductivity of the atmosphere or the radiation received from the sun or emitted to space are cited. (*Same item as* 9.10–144, Oct. 1958, *Met. Abs.*) *Subject Headings:* **1. Atomic explosion effects on weather. I. Langmuir, I.**—*M.R.*

**11M–690** 551.509.617

Berry, Frederick A., **The evaluation of weather modification experiments.** *American Water Works Association, Journal*, 48(8):973–981, Aug. **1956.** 7 figs., table. **DLC**—The author discusses the theory underlying the use of AgI and dry ice to seed clouds, difficulties encountered in the practical application of this theory in that the relative frequency of occurrence of subcooled water droplets or of ice crystals is unknown, the circumstances under which and the frequency with which artificial nuclei released at the ground are carried aloft. The evaluation of the excess precipitation resulting from cloud seeding by choice of target and control areas and the application of this evaluation in Santa Barbara County, California under the auspices of the President's Advisory Committee on Weather Control are described. The results of the cloud seeding experiments are summarized with the aid of graphs and it is shown that the average increase in precipitation for 51 seeded storms was 16 per cent in rainfall above the expected. The average increase in runoff for five years was about 10 per cent. The special topographic, operational and statistical conditions associated with the Santa Barbara experiments are stressed and the impropriety of extrapolating the results obtained to other areas is stressed. *Subject Headings:* **1. Cloud seeding evaluation 2. Cloud seeding with dry ice 3. Cloud seeding with silver iodide 4. Santa Barbara County, Calif.**—*I.L.D.*

**11M–691** 551.574.2:551.509.617:541.14

Birstein, S. J., **The role of adsorption in heterogeneous nucleation, Pt. 2, The adsorption of water vapor on photolyzed silver iodide.** *Journal of Meteorology*, 13(4):395–398, Aug. **1956.** 6 figs., 12 refs. **DWB**—The effectiveness of AgI as a nucleating agent depends on its ability to adsorb and orient water molecules, and is destroyed by photolyzation by UV or sunlight. Adsorption by photolyzed and unphotolyzed AgI and lead iodide was studied at +20 and −20°C. As the AgI surface is reduced, adsorption increases but the orientation of the water molecules changes in such a way as to inhibit adsorption of ice-oriented layers, so that at −20°C the photolyzed material does not form an ice crystal. For **Pt. 1,** see 11M–584. (*Same item as* 7.11–243, Nov. 1956, *Met. Abs.*) *Subject Headings:* **1. Silver iodide properties 2. Photolytic inactivity.**—*C.E.P.B.*

**11M–692** 551.509.617

Boucher, Roland J., **A brief statement regarding the results of "Operation Overseed" August 1955 through January 1956.** *Mount Washington Observatory, Gorham, N. H., News Bulletin*, No. 29:10, April **1956.** photo. **DWB**—Operation Overseed has, from Aug. 1955 to Jan. 31, 1956, made numerous tests to determine how much AgI released by ground generators actually reaches cloud level under varying conditions, and whether or not certain concentrations of AgI can inhibit precipitation by means of overseeding. Photographs and moving pictures are used to document conditions and samples are obtained in clouds to determine concentration of nuclei, etc. Work is being done on or near Mt. Washington, N. H. *Subject Headings:* **1. Operation Overseed 2. Cloud seeding with silver iodide 3. Overseeding 4. Mt. Washington, N. H.**—*M.R.*

**11M–693** 551.509.6:551.585.5

Brier, Glenn W. (*U. S. Weather Bureau, Wash., D. C.*), **Some problems in utilizing water resources of the air.** (In: White, Gilbert F. (*ed.*), **The future of arid lands.** *American Association for the Advancement of Sciences, Wash., D. C.* Publication No. 43, **1956.** p. 314–319. 12 refs.) **DLC**—The various problems connected with the collection and interpretation of the meteorological data needed to control weather in arid regions are discussed. These include a survey of the moisture resources available in the atmosphere, especially in the form of clouds, the temporal and spatial distribution of freezing nuclei, and the use of these data in cloud seeding operations for estimating the economic value of weather modification, etc. (*Same item as* 9.10–145, Oct. 1958, *Met. Abs.*) *Subject Headings:* **1. Weather control in arid zones 2. Cloud seeding 3. Arid zones.**—*I.L.D.*

**11M–694** 551.501.9(744)

Brooks, Charles F. (*Pres. Mt. Wash. Obs.*), **The Mt. Washington Observatory.** *Weatherwise*, Boston, 9(5):151–154, Oct. **1956.** 2 photos, table. **DWB**—The history, directorship and activities of the Mt. Washington Observatory and its staff (with brief tables giving monthly temperature, precipitation, wind, and cloud averages, extremes and frequencies) are discussed and illustrated. Many important projects in cloud physics, icing, cosmic rays, aerodynamics, snow crystals and cloud seeding are underway, in addition to routine synoptic observations which supplement rawinsonde

data from nearby stations. (*Same item as* 8.10–44, Oct. 1957, *Met. Abs.*) *Subject Headings:* **1. Mt. Washington Observatory 2. Mountain meteorology 3. Mt. Washington, N. H.**—*M.R.*

**11M–695** 551.509.617(09)

Byers, Horace R. (*Chic. U.*), **Historical resume of research relating to weather modification.** (In: Conference on the Scientific Basis of Weather Modification Studies, Arizona Univ., Tucson, April 1956, **Proceedings.** pub. **1956.** 8 p. 3 refs.) **DWB**—Early attempts at modifying the weather or producing rain (1839–1945) are reviewed, the scientific studies of rain forming or of cloud physics processes which made possible the advances since 1946 when SCHAEFER et al. made their first dry ice (and later silver iodide) experiments, Project Cirrus, tropical (warm) rain formation and other phases of cloud physics research in many countries are reviewed, with special reference to the 3 bibliographies on cloud physics and rain making in Vol. I and VI of Met. Abs. (*Same item as* 9.4–111, April 1958, *Met. Abs.*) *Subject Headings:* **1. History of weather control 2. Cloud physics research 3. Cloud seeding experiments.**—*M.R.*

**11M–696** 551.574.1

†Chicago. Univ. Dept. of Meteorology, **Cloud physics research.** Contract AF 19(604)-618, Final Report under Contract, Jan. 31, **1956.** 32 p. fig., 7 tables, 51 refs. List of 38 scientific publications under partial or total sponsorship of the Contract p. iv–vii.—A summary of the work done and conclusions drawn from the work in the laboratory and in the field, in the Midwest and in Puerto Rico, during 1953–5 under this contract. Instrumentation, flight and field programs, physics and chemistry of atmospheric particles, studies of cloud growth and precipitation mechanisms (growth of Cu clouds, buoyancy of clouds and precipitation formation, liquid water content, shape of raindrops, formation of lines of convective clouds, etc.). Conclusion is that precipitation can be induced in tropical clouds by injecting water droplets and that the water coalescence process is paramont even in the Midwest during summer. *Subject Headings:* **1. Cloud physics research 2. Cloud seeding with water 3. Puerto Rico. I. Byers, H. R.**—*M.R.*

**11M–697** 551.509.616:551.576.11(47)

*Chuvaev, A. P., **Ob usloviiakh blagopriiatnykh dlia iskusstvennogo vyzyvaniia osadkov iz moshchnykh kuchevykh oblakov.** [Favorable conditions for the artificial production of precipitation from heavy cumulus clouds.] *Meteorologiia i Gidrologiia*, No. 11:15–20, Nov. **1956.** 2 figs., 2 tables, 7 refs. **DWB, DLC**—The most essential characteristics of cumulus congestus clouds are analyzed on the basis of observations made during airplane flights in northwestern regions of European U.S.S.R. and in southern European U.S.S.R. Data are presented in frequency of different vertical thicknesses of Cu congestus clouds and frequency of temperatures of the upper boundaries of Cu congestus clouds. The data indicate that, in southern regions of the U.S.S.R., the frequent occurrence of Cu congestus clouds make it possible to obtain by artificial means precipitation of economic significance. (*Same item as* 10.3–176, March 1959, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Cloud seeding 3. Cumulus clouds 4. European U.S.S.R.**—*I.L.D.*

**11M–698** 551.509.617

Conference on the Scientific Basis of Weather Modification Studies, Univ. of Arizona, Tucson, April 10–12, 1956, **Proceedings.** pub. by Univ. of Arizona, **1956.** each paper repaged. Abstracts of most papers presented at Conference, with full reproduction of two. Review by James E. McDonald in *American Meteorological Society, Bulletin*, 37(6):318, June **1956** and in *Science*, Wash., D. C., 124(3211):86–87, July 13, **1956.** Review and summaries by H. Dessens in *Puy de Dôme. Observatoire, Bulletin*, Ser. 2, No. 3:88–94, July/Sept. **1956. DWB**—The preprints and abstracts of papers not in preprint form, for the Conference at Tucson on weather modification, were re-run in this Conference Proceedings along with the two papers cited above by BYERS and by HOUGHTON. General conference notes include a summary of objectives, agenda, list of 35 participitants and 39 observers and their affiliations, and other transactions. The conference was broadened to include all aspects of weather modification as well as cloud modification, as their history, a survey of cloud nucleation program, cloud seeding laboratory and field experiments; their planning and evaluation, including also the theoretical basis of nucleation. Thanks to the Rockefeller Foundation, scientists from Australia, Mexico, France, Israel, Canada, Japan, England, Sweden and Switzerland were able to attend. The President's Advisory Committee on Weather Control was criticized because of limited, non-controlled and non-randomized seeding data, and inherent defects in statistical techniques. The main conclusions regarding effectiveness of cloud seeding carried out during the past 5 or 6 years were summed up and the impressions of the layman as well as the scientist expressed in the words of REICHELDERFER as "realistic optimism" where heretofore has been a wide range of feeling from wild enthusiasm to complete pessimism.

The papers presented are the following:

Harwill, Richard A.: **Greetings to the Conference on the Scientific Basis of Weather Modification.** 2 p.

Byers, Horace R.: **Historical resume of research relating to weather modification.** 8 p. (for abstract *see* 11M–695)

Petterssen, S.: **A brief survey of the artificial cloud nucleation program.** 1 p.

Spar, Jerome: **A large-scale experiment in weather modification.** 1 p.

Hall, W. Ferguson: **Cloud-seeding potential in middle-latitude cyclones.** 2 p.

aufm Kampe, H. J.; Kelly, J. J. and Weickmann, H. K.: **Seeding experiments in supercooled stratus type clouds.** 2 p.

Weickmann, H. K.: **Stratus cloud seeding in Western Germany, January and February 1956.** 3 p.

Bowen, E. G.: **An aircraft seeding operation in the Snowy Mountains area of Australia and further experiments on silver iodide decay.** 1 p.

Fournier d'Albe, E. M.: **Some remarks on the planning and evaluation of experiments in cloud seeding with hygroscopic particles.** 2 p.

Hales, J. Vern; Hoffer, Thomas E.; Peck, Eugene L. and Anderson, C. Keith: **Cloud seeding evaluation in Utah.** 2 p.

Neumann, J.: **Artificial stimulation of precipitation: a report on activities in Israel.** 3 p.

Reichelderfer, F. W.: **Some conclusions from field tests and studies of cloud seeding by the Weather Bureau.** 2 p.

Decker, Fred W.; Lincoln, Russell L. and Day, John A.: **Weather modification operations should not choke off their own development.** 2 p.

Battan, Louis J.: **Design of the University of Chicago cloud modification experiments.** 2 p.

Byers, Horace R.: **Results of the University of Chicago cloud modification experiments.** 2 p.

Godson, Warren L.: **The statistical combination of results in the evaluation of weather modification projects.** 2 p.

Brier, G. W.: **An appraisal of some statistical results from weather modification studies.** 2 p.

Thom, H. C. S.: **An evaluation of a series of orographic cloud seeding operations.** 2 p.

Brownlee, K. A.: **Statistical tests by the method of a control of the rain-making hypothesis: some alternative viewpoints.** 2 p.

Neyman, Jerzy: **Observational prerequisites to a decisive statistical evaluation of cloud seeding operations.** 2 p.

Anderson, Charles E.: **Some remarks on general principles of weather modification.** 1 p.

Ludlam, F. H.: **Problems of weather modification.** 1 p.

McDonald, James E.: **Climatological studies prerequisite to a weather modification program.** 2 p.

Mason, B. J.: **Some fundamental problems in large-scale cloud seeding.** 2 p.

Braham, Roscoe R., Jr.: **Systematic cloud studies as a prerequisite for cloud modification experiments.** 1 p.

Kassander, A. Richard, Jr.: **Some field studies basic to cloud physics research.** 2 p.

Sänger, Raymund: **On the structure of ice-forming nuclei.** 2 p. (see 11M–732)

Schaefer, Vincent J.: **Ice crystal nuclei in the free atmosphere.** 1 p.

Hatakeyama, H.: **The formation of freezing nuclei on a plane and some other developments in the rainmaking experiment made in Japan.** 1 p.

Hosler, C. L.: **Control of ice formation in clouds in order to produce maximum precipitation growth.** 3 p.

Woodcock, A. H.: **Suggestions for cloud modification research derived from studies of sea salt in the air and in rains.** 2 p.

Dessens, Henri: **From rain stimulation to cumulus stimulation.** 2 p.

Cunningham, R. M.: **Humidities and air circulations in and around cumulus clouds.** 2 p.

Workman, E. J.: **Thermodynamic processes and cloud seeding.** 1 p.

Vonnegut, B. and McMahon, H. O.: **A possible effect of cloud seeding on the efficiency of energy transformation.** (Title only. No abstract.) 1 p.

Mason, B. J.: **Microphysical aspects of cloud seeding.** 3 p.

Spar, Jerome: **The problem of modification of large-scale cloud systems: summary paper.** 2 p.

Woodbury, Max: **The Advisory Committee for Weather Control statistical program.** 2 p.

Bowen, E. G.: **Summary talk on cloud seeding and seeding technology.** 3 p.

Houghton, Henry G.: **Some impressions at the close of the conference.** 5 p. (for abstract *see* 11M–705)

*Subject Headings:* **1. Weather modification conferences 2. Cloud physics symposia 3. Artificial precipitation 4. Cloud seeding effectiveness 5. Statistical tests of cloud seeding 6. Tucson, Ariz. I. Arizona. Univ. Institute of Atmospheric Physics II. Byers, H. R. III. Houghton, H. G.**

**11M–699** 551.509.616:551.576.11:551.558.1(675)

Dessens, Henri (*Puy de Dôme Obs.*), **Essai de formation artificielle de cumulus par utilisation exclusive de l'énergie solaire.** [Attempt to produce cumulus clouds artificially, using only solar energy.] *Puy de Dôme. Observatoire, Bulletin*, Ser. 2, No. 4:113–125, Oct./Dec. **1956.** 6 figs., 4 tables, 10 refs. French and English summaries p. 113. **DWB**—An experimental project conducted in the Lukolela region (1°S, 17°E) of the Belgian Congo had as its object the production of artificial cumulus by superheating of a clearing (in the tropical forest) with surface blackened by burning the grass and shrubs. In the center of a clearing of 25 ha (not large enough to produce convective clouds successfully) there was a laboratory for measuring radiation, temperature, humidity, wind and clouds. Brush fires in the center of other clearings did produce cumulus clouds which were studied and photographed along with those which seemed to form over the clearings in the early morning but were undistinguishable from those forming over the forests during the day. Factors which might have resulted in the "feeble super heating" of the burned clearings were: 1) radiation reduction by daytime cloudiness; 2) soil moisture which is excessive in the clearings; 3) surface winds which reduce temperature gradients as soon as formed (data given for 0830, 1930, 1430 and 1600 h for 0 m to 2,000 m above ground). Winds die out aloft and toward evening, but are quite fresh at the time of greatest heating (in morning). The coupling of the "clearing effect" of the superheated surface, with the "cumulus effect" involving entrainment, release of energy and convective action, is shown schematically by a series of diagrams in some respects similar to the LUDLAM and SCORER (1953) theory of convective bubbles. (*Same item as* 10.10–183, Oct. 1959, *Met. Abs.*) *Subject Headings:* **1. Artificial cumulus formation 2. Burned clearing effects 3. Convective coupling theory 4. Bubble theory 5. Lukolela, Belgian Congo.**—*M.R.*

**11M–700** 551.509.617(675)

Dessens, Henri and Dessens, Jean, **La formation artificielle de grands cumulus producteurs de pluie.** [Artificial production of large cumulus rainclouds.] *Académie des Sciences, Paris, Comptes Rendus*, 243(11):814–817, Sept. 10, **1956. DLC**—Five experiments are described in which cumulus clouds yielding weak precipitation were produced in clear sky conditions by brush fires lighted near Lukolela (Belg. Congo) in July 1956. Precipitation was slight because S.E. currents prevented the cloud tops from reaching the freezing level; for the same reason, the use of seeding agents (AgI and NaCl) was ineffective. Apart from the case of supercooled stratus clouds, the conflagration method is claimed to be the first to produce precipitation reaching the ground in drops having diameters of several mm. The direct effect of the fires cannot be doubted, as the clouds were produced in an otherwise cloudless sky and no other precipitation fell near the experimental site during the whole month. (*Same item as* 9.8–144, Aug. 1958, *Met. Abs.*) *Subject Headings:* **1. Brush fire cloud formation 2. Artificial precipitation 3. Belgian Congo.**—*G.T.*

**11M–701** 551.509.617

Dufour, L. (*Inst. Roy Mét., Uccle, Belgium*), **Quelques considérations sur les précipitations artificielles.** [Comments on artificial precipitation.] *Scientia*, Milan, 91(528):114–117, April **1956. DWB, DLC**—The author shows that, even though artificial precipitation was achieved without a doubt in certain cases, the problem cannot be considered as solved. Artificial precipitation can be produced only in regions where the atmospheric circulation will allow it. The economic usefulness of large-scale seeding is examined. The conclusion is that for the present it would be preferable to reduce large-scale seeding experiments and concentrate instead on purely scientific research. (*Same item as* 9.8–145, Aug. 1958, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding.**—*A.V.*

**11M–702** 551.576.11:551.558.21

Eber, Laurence E. and Seely, Ben K., **A chemical tracer experiment in orographic clouds.** *Journal of Meteorology*, 13(6):548–553, Dec. **1956.** 6 figs., table. 2 refs. **DWB**—Tests were carried out by spraying water containing copper sulfate into cloud formed by a nearly vertical 1500 ft cliff normal to trade wind in Maui, Hawaii. The droplets were sampled by filter papers exposed at a number of sites down-wind, which showed the spray plume to have an angular width of 30°. The stream lines were constructed from time-lapse movies. Size distribution of droplets (shown by histograms) indicates an increase of median diameter down-wind; drops <0.156 mm decreased from 58% near spray to 33% a few miles away. The most favorable conditions for spraying occurred with moderate cloud and little or no rain. (*Same item as* 8.5–255, May 1957, *Met. Abs.*) *Subject Headings:* **1. Orographic cloud coalescence 2. Hawaii.**—*C.E.P.B.*

**11M–703** 551.509.617

Godson, Warren L. (*Met. Services of Canada*), **Induced precipitation.** *Canadian Society of Agronomy, 2nd Annual Meeting, Univ. of Toronto, June* 25–28, 1956, *Proceedings, Sec. C*, p. 13–16. fig. **DA**—A general discussion of cloud seeding and the cloud mechanisms which make seeding effective in various types of clouds and temperature and moisture conditions. A "flowchart" shows

the various stages of cloud physics processes for stratus and convective types of clouds (ice and water types) and the end products of drizzle, snowflakes, raindrops, soft hail, hailstones, etc. *Subject Headings:* **1. Cloud seeding 2. Artificial precipitation.**—*M.R.*

**11M–704** 551.509.617(52)

Hatakeyama, H. (*Met. Res. Inst.*), **Artificial rain-making in Kanto District.** *Papers in Meteorology and Geophysics*, Tokyo, 7(3):333–335, Oct. **1956.** 5 refs. **DWB**—This paper reports a series of basic researches concerning the artificial modification of clouds in Kanto District. These researches were carried out by members of the Division of Meteorology sponsored by Tokyo Electric Power Co. Five types of experimental techniques carried out at different places during 1955–1956 are discussed. The paper also reports the progress to date of Tokyo Electric Power Co. experiments on practical and long-term AgI smoke generation, aiming at the increase of the precipitation amount at the hydroelectric resources areas. (*Same item as* 12.1–266, Jan. 1961, *Met. Abs.*) *Subject Headings:* **1. Artificial cloud modification 2. Cloud seeding studies 3. Kanto District, Japan.**—*I.S.*

**11M–705** 551.509.6 551.574.1(06)

Houghton, Henry G. (*Dept. of Met., M. I. T.*), **Some impressions at the close of the Conference.** (In: Conference on the Scientific Basis of Weather Modification Studies, Arizona Univ., Tucson, April 1956, **Proceedings.** pub. **1956.** 5 p.) **DWB**—Notes presented in the closing lecture of the conference, giving the authors' ideas of the real progress that has been made in scientific weather control: the question "Does it work?" has shifted . . . and revolves around the question "How well does it work?" Microphysical studies have proceeded satisfactorily. Warm cloud rainfall in tropics is not thoroughly understood, overseeding is not as important as once believed, large scale effects are debatable, statistical evaluation is no better than the crude rain gage measurements on which it is based and, finally, we are just entering the "Golden age of progress" in weather modification, and in fact in the entire field of meteorology. (*Same item as* 9.6–47, June 1958, *Met. Abs.*) *Subject Headings:* **1. Weather modification progress 2. Cloud physics conference.**—*M.R.*

**11M–706** 551.594.21:551.576.11

Imianitov, I. M. and Chuvaev, A. P., **K voprosu ob usloviiakh perekhoda moshchnykh kuchevykh oblakov v grozovye.** [Problem of the conditions attending the transformation of large cumulus clouds into thunderstorm clouds.] *Meteorologiia i Gidrologiia*, Leningrad, No. 2:15–19, Feb. **1956.** 5 figs., 2 tables, ref. **DWB, DLC**—The author evaluates the results of a study of the electrical properties of developing thunderstorm clouds during different stages of their life (from the moment of appearance to the falling of precipitation and the manifestation of thunder) and their comparison with the general properties of cumulus cloud development and with their microstructure. Data are given on the change in electrical field of large cumulus clouds during the artificial formation of ice crystals and photographs and radarscope diagrams of the various developmental states are presented. The electrical field in large cumulus clouds increases markedly when supercooled ice particles appear. The probability of transition to thunderstorm stage is determined by the relationship of the thickness of the supercooled and warm parts of the cloud. In purely aqueous clouds the growth of electrical field depends only to a slight degree upon their vertical thickness. (*Same item as* 8.9–319, Sept. 1957, *Met. Abs.*) *Subject Headings:* **1. Thunderstorm electricity 2. Cumulonimbus development.**—*I.L.D.*

**11M–707** 551.509.617:551.574.1

Isono, K.; Fujita, H. and Komabayasi, M. (*all, Geophysical Inst., Tokyo Univ.*), **Change in droplets spectrum and water content of a cloud induced by salt water seeding.** *Meteorological Society of Japan, Tokyo, Journal*, Ser. 2, 34(4):177–184, Aug. **1956.** 9 figs., 6 refs. **DWB, DLC**—An experiment on the cloud modification by spraying NaCl saturated solution directly into clouds was conducted. An atomizer was set at the windward slope of a mountain, and droplets of the salt solution were introduced into clouds when the clouds were ascending along the slope and covered the observation points which were located 1800 m above sea level. Marked changes in size spectrum of cloud elements, and the subsequent rapid decrease in cloud water content caused by onset of precipitation were observed. This result showed that the first stage of precipitation was induced within a few minutes by spraying a relatively small number of NaCl droplets into the cloud which had been colloidally stable. (*Same item as* 9.9–146, Sept. 1958, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with salt 2. Cloud droplet size distribution 3. Water content of clouds.**—*Authors' abstract.*

**11M–708** 551.509.617:551.574.1

Itoo, K. and Hama, K. (*both, Met. Res. Inst., Tokyo*), **Freezing of supercooled water-droplets, Pt. 1, Preliminary report.** *Papers in Meteorology and Geophysics*, 6(3/4):246–254, Jan. **1956.** 20 figs. (incl. photos), 6 refs. **Pt. 2,** *Ibid.*, 7(2):99–106, July **1956.** 12 figs. (incl. photos), 2 tables, ref., eq. **DWB**—In Pt. 1, an experiment was conducted in which a water droplet was frozen to find the effects of artificial rain making. Taking a distilled water drop, a drop of silver iodide suspension

in pure water and raindrop, their freezing temperature was observed. As the variance of the temperature was great in each case, some improvement was found necessary for practical use. In Pt. 2, many supercooled water droplets were frozen on a cooling brass plate to find the effects of artificial rain making. The water droplets were contaminated with silver iodide smoke and some soil and mineral powder. Freezing temperature was found for each contaminated substance. Freezing temperature of melted snow crystals was observed. (*Same item as* 9.10–150, Oct. 1958, *Met. Abs.*) *Subject Headings:* **1. Freezing of supercooled water 2. Cloud seeding experiments 3. Freezing point of water.**—*Authors' abstract.*

**11M–709** 551.509.617(524)

Kobayashi, T. (*Inst. of Low Temp. Sci., Hokkaido Univ.*) and Okita, T. (*Asahikawa Branch of Hokkaido Gakugei Univ.*), **Outline of the studies on artificial precipitation in Hokkaido District.** *Papers in Meteorology and Geophysics*, Tokyo, 7(3):328–330, Oct. **1956.** table, 2 refs., eqs. **DWB**—In Hokkaido District, the operation of cloud seeding with AgI smoke or NaCl particles was not carried out in the last two years, on account of copious rainfall in the hydroelectric power source area which led to disastrous flood on the lower part of the rivers. Only a few trial seedings with a ground based AgI generator were conducted by the Hokkaido Electric Power Co. at Eoroshi (in the mountainous district of Daisetsu) in the summer of 1954. Our efforts have been directed toward basic research on the mechanism of precipitation and on artificial weather modification rather than on the practical seeding operation. (*Same item as* 9.10–148, Oct. 1958, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding effects 2. Artificial precipitation 3. Precipitation mechanics 4. Hokkaido District, Japan.**—*Authors' abstract.*

**11M–710** 551.509.617(766)

Krick, Irving P., **Results of cloud-seeding operations to augment municipal water supplies.** *American Water Works Association, Journal*, 48(10):1250–1263, Oct. **1956.** 6 figs., table, 19 refs. **DLC**—Isohyetal and other charts are presented to show an apparent increase in precipitation during 1953, 1954 and 1955 or one or two of these years, at Dallas, Oklahoma City, Springfield, Mo., Shreveport, La., and Denver, Colo., during storms when the Water Resources Development Corporation (of which the author is head) seeded targets in the reservoir watersheds (with AgI from ground generators). Only a portion of the added water in the reservoirs, or extra precipitation, is attributed to cloud seeding, but the author presents figures which attempt to show that cloud seeding is the most economical method of increasing water supply, ground water or soil moisture for farming. Principles of cloud seeding as well as case histories are treated. (*Same item as* 9.1–160, Jan. 1958, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding case histories 2. Economic aspects of weather modification 3. Dallas, Tex. 4. Denver, Colo. 5. Oklahoma City, Okla.**—*M.R.*

**11M–711** 551.509.617:546.57:546.15(729.1)

Lamb, A. J., **La producti6n de lluvia artificial.** *Asociación de Técnicos Azucareros de Cuba*, **Habana, Memorias de la Conferencia Anual,** 30:99–101. **1956.** table. **DA** (65.9 As5)—The natural conditions for artificial precipitation are surveyed. Silver iodide seeding depending on climatic conditions is explained by the example of Bermuda. The indecisive report of 1953 of the U. S. Advisory Committee on Weather Control is quoted. Programs of silver-iodide or dry ice seeding by Howell Associates in Canada, the United States, Peru, Colombia and Cuba in 1951–1955, resulted in a 17–20% average increase of precipitation. More precise results are expected by extending the operations from Oriente and Camaguey to Las Villas, Matansas and La Habana. *Subject Headings:* **1. Artificial precipitation 2. Cloud seeding with silver iodide 3. Cloud seeding in Cuba 4. Cuba.**—*O.T.*

**11M–712** 551.509.617

Larkin, W. Keith, **I change weather.** *Flying*, N. Y., 58(5):23–25, 59–61, May **1956.** port., 7 photos. **DWB**—Author is pilot of the P-40 aircraft used in coordination with a mobile radar meteorological station and a ground generator for successful cloudseeding to produce rain, or to convert hailstorms into light drizzles. Findings of the Weather Modification Co. of Redlands, California, or of the pilot can be summed up as follows: (1) Seeding of individual storm cells with dry ice or silver iodide (as the case may require), one sec. on-three sec. off, has a definite local result of precipitation. (2) Duration of seeding effect in form of precipitation lasts the time required for a cloud to drift 20–30 mi. (3) Overseeding reduces natural rain. *Subject Heading:* **1. Cloud seeding effectiveness.**—*W.N.*

**11M–713** 551.574.1:551.576.1 551.509.617

Ludlam, F. H., **The structure of rainclouds.** *Weather*, 11(6):187–196, June **1956.** 2 plates, 2 tables. Reprinted from *The Times Science Review.* **DWB**—The causes of formation of different cloud types are described. The initiation and growth of cloud droplets, formation of ice crystals,

and aggregation processes are next considered, then the conditions for formation of rain and time needed for it to develop, which in some cases exceeds the life of cloud particles. Only multilayer clouds always precipitate. The artificial production of precipitation is described but the effectiveness is still uncertain. (*Same item as* 8.1–269, Jan. 1957, *Met. Abs.*) *Subject Headings:* **1. Cloud physics 2. Artificial precipitation.**—*C.E.P.B.*

**11M–714** 551.509.617:546.57:546.15

Mason, Basil John and Hallett, J., **Artificial ice-forming nuclei.** *Nature*, London, 177(4511): 681–683, April 14, **1956.** 2 figs., table, 9 refs. **DWB**—Silver iodide is an effective nucleating substance below −5°C. A number of other pure substances were tested by an experimental procedure which is described, but mostly failed to produce ice crystals above −40°C. Lead iodide was effective at −7°C and mercuric chloride at −25°C. The techniques used in silver iodide generators may not be the most efficient; AgI particles are reduced at high temperatures and by ultraviolet radiation, and their ice-nucleating properties largely inhibited. Lead iodide is more stable and may be a practicable substitute. (*Same item as* 7.9–119, Sept. 1956, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding techniques 2. Silver iodide nuclei 3. Lead iodide nuclei.**—*C.E.P.B.*

**11M–715** 551.509.6:551.511:623.454.8

Mason, Basil J., **Man's influence on the weather.** *Advancement of Science*, London, 12(49):498–504, June **1956.** fig. **DLC**—The energy of large scale atmospheric processes is so great that they can only be influenced indirectly. The radiation balance in the troposphere is analyzed and the unstable heat and water vapor circulation between low and high latitudes, which determines large scale weather, is described. Weather modification by changing the radiation balance through a dust or artificial cloud layer, triggering of dynamical disturbances or modification of the hydrological cycle is not practicable on a large scale, but reduction of evaporation from water surfaces by monomolecular layers is being tried in Australia. It is unlikely that H-bombs can have more than a local transient effect. Cloudseeding experiments are encouraging but difficult to evaluate. (*Same item as* 8.4–140, April 1957, *Met. Abs.*) *Subject Heading:* **1. Artificial influences on weather.**—*C.E.P.B.*

**11M–716** 551.574.1 551.509.617

†Mason, B. J., **The nucleation of supercooled water clouds.** *Science Progress.* 44(175):479–499, July **1956.** 3 figs., 2 tables, 39 refs. **DWB**—A thorough discussion of the whole problem of freezing of supercooled water droplets. Very pure water freezes spontaneously at about −40°C in the laboratory, the rate increasing 6-fold for every 1°C fall of temperature. The freezing temperature of water containing foreign nuclei depends on drop diameter and on the conditions of the experiment, and diverse results by different workers are described. The mechanics of freezing is considered. Cloud chamber measures of the ice-nucleus concentration in the atmosphere are listed; the *minimum* concentration ranges from about 1/m³ at −10°C to 1/cm³ at −35°C. The nature of nuclei is discussed; silicates are suitable, BOWEN'S meteoritic hypothesis is rejected. The nucleus concentration of 150/liter necessary for steady rain is attributed to splintering of snowflakes, bursting of freezing water drops and increased activity of nuclei after once being involved in ice crystal formation. Artificial ice nuclei are next considered, especially AgI and $PbI_2$; the apparent effectiveness of other substances (except $HgCl_2$ effective at −25°C) is due to contamination by these. (*Same item as* 7.9–8, Sept. 1956, *Met. Abs.*) *Subject Headings:* **1. Freezing nuclei 2. Cloud seeding.**—*C.E.P.B.*

**11M–717** 551.574.1:551.509.617

†Montmory, R. (*CNRS Thermodynamic Lab. Clermont-Ferrand*), **Congélation de l'eau surfondue sur une surface cristalline.** [Freezing of supercooled water on a crystalline surface.] *Puy de Dôme. Observatoire, Bulletin*, Ser. 2, No. 4:126–147, Oct./Dec. **1956.** 22 figs., table, 21 refs. French and English summaries p. 126. **DWB**—Report on elaborate experiments to see what actual processes are involved in freezing of supercooled water on crystals of Mica, $PbI_2$, $AgI^{\gamma}$ and silver. Microphotographs (100×enlargement) show the orientation of the epitaxy or ice formation in relation to the orientation of the nucleating crystal. It is concluded that the nucleus does not need to resemble an ice crystal in form to be effective (silver worked just as well as AgI), and that 2 kinds of active nuclei do not interfere with each other. Data are given for each type of nucleating agent and conditions in the experiment, molecular structure, explanation of results, etc. set forth and illustrated. (*Same item as* 9.9–232, Sept. 1958, *Met. Abs.*) *Subject Headings:* **1. Ice formation on crystals 2. Nucleation of supercooled water 3. Epitaxy 4. Silver iodide nucleating process.**—*M.R.*

**11M–718** 551.509.617:546.57:546.15

§*Mount Washington Observatory, Gorham, New Hampshire, **Operation overseed: Final report to the Advisory Committee on Weather Control, Dec. 1955–June 1956.** Issued, Milton, Mass., Nov. **14, 1956.** 116 p. figs., tables, refs. **DWB**—An analysis of 61 attempts at seeding clouds in

the Mt. Washington area to show the efficacy of AgI in producing ice nuclei downwind. From 3 to 28 ground generators were used during 3000 hrs from Dec. 1, 1955 to June 15, 1956. The maximum concentration at 12 mi distance was $10^4$ to $10^5$ nuclei/$m^3$ at −20°C. Each attempt is analyzed synoptically (surface and 850 mb synoptic charts) and aerologically (Portland, Me. sounding), and from the point of view of meteorological and cloud physics parameters. Decay occurred at the rate of 2 orders of magnitude in 30 min exposure at −15°C when the AgI in acetone and propane method was used. A definite increase in nuclei was noted in half of the cases. Photos, tables and graphs are included along with the discussion and synoptic analysis. It was concluded that "overseeding" of supercooled clouds with large numbers of AgI particles was not possible even with 28 generators operating simultaneously. Proper targetting was most important factor and best results occurred with unstable lapse rates. The 61 attempts were made under carefully chosen conditions with respect to air flow between generators and Mt. Washington Observatory where the nuclei counts were made. (*Same item as* 8.10–117, Oct. 1957, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding effectiveness 2. Silver iodide effectiveness 3. Operation Overseed 4. Silver iodide rate 5. Mt. Washington, N. H. I. Boucher, Roland J. II. U. S. Advisory Committee on Weather Control.**—*M.R.*

**11M–719** 551.509.617

Mount Washington Observatory, Gorham, N. H., **Operation Overseed: Interim Report to the Advisory Committee on Weather Control, Aug.–Nov. 1955.** Milton, Mass., Jan. 10, 1956. unpaged. Tables. Numerous charts and graphs. **DWB** (M09.67 B753oi 1955)—An analysis of 17 silver iodide seeding operations conducted in Sept., Oct., and principally in Nov. 1955, in the Mt. Washington, N. H. area shows that on four occasions the ice nuclei count at the summit of Mt. Washington (6293 ft) was probably increased by one or more orders of magnitude as a direct result of the seeding. The analysis further shows that on these occasions the optimum conditions of steep lapse-rate, absence of inversions and favorable air trajectory were obtained. On most of the occasions when an increase in the nuclei count could not be detected, the atmosphere below the level of Mt. Washington was stable, an inversion was usually present. On one or two occasions when lapse-rate conditions were favorable, the wrong air trajectory was assumed. (*Same item as* 9.5–126, May 1958, *Met. Abs.*) *Subject Headings:* **1. Operation Overseed 2. Cloud seeding with silver iodide 3. Mt. Washington. I. Boucher, Roland J. II. Smith, Robert B.**—*Author's abstract.*

**11M–720** 551.509.617

Neuwirth, R., **Künstlicher Regen? Entwicklung und Probleme der experimentellen Niederschlagsbeeinflussung.** [Artificial rain? Development and problems of experimental rainfall modification.] *Umschau*, Frankfurt a.M., 56(9):257–259, May 1, 1956. fig., 16 refs. **DLC**—The investigation of physics of cloud and precipitation which began in 1938 with W. Findeisen is described. Radar showed that in temperate latitudes heavy rain mostly passed through an ice phase. Numerous researches showed the importance of condensation nuclei. Extensive experiments in U. S. on inoculation with dry ice or especially silver iodide showed a probable but not certain positive effect. Overseeding has been used to disperse thunder clouds. (*Same item as* 7.10–111, Oct. 1956, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding**—*C.E.P.B.*

**11M–721** 551.509.617

Oddie, B. C. V., **The Meteorological Office experiments on artificial rainfall.** *Weather*, 11(3):65–71, March 1956. fig. **DWB**—The Bergeron process of natural rain formation is explained. Seeding with dry ice and silver iodide is discussed. The experiment with a row of generators on Salisbury Plain is described, including studies of diffusion of zinc-cadmium sulfide particles. Six trials were made but results are not given. (*Same item as* 8.2–101, Feb. 1957, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding experiments.**—*C.E.P.B.*

**11M–722** 551.509.617

Oddie, B. C. V., **Rain-making.** *Agriculture*, London, 62(11):512–515, Feb. 1956. **DA**—The development of the idea of rainmaking is traced. It is argued that rainfall in one region can only be slightly increased (not originated) at the expense of some other regions. Results of trials are inconclusive. The Salisbury Plain experiments are briefly described, but it is too early to form conclusions. (*Same item as* 8.3–131, March 1957, *Met. Abs.*) *Subject Heading:* **1. Artificial precipitation.** —*C.E.P.B.*

**11M–723** 551.509.615:547.213

Olivier, J. (*Aéroport de Lyon-Bron*), **Essais d'atténuation artificielle du brouillard.** [Experiment at artificial attenuation of fog.] *Puy de Dôme. Observatoire, Bulletin*, Ser. 2, No. 1:4–6, Jaan./Mrch 1956. fig., 2 refs. **DWB**—On Jan. 22, 1956, between 08:30 and 09:30 h, two attempts were made to dissipate fog by means of release of propane gas from bottles at Lyon-Bron Airport. The temperature

was −3° to −4°C and the fog unusually dense (visibility 40 m). The 17 kg bottles of propane cos 1740 fr each (100 fr/kg). The effects, as shown on the transmissometer record reproduced herei were a marked lowering of the density from 25 to <10 (visibility raised from 50 to 130 m) and sudden increase in density as wind drifted a wall of dense fog back over the line of the transmis someter. Particles of snow were seen to fall rapidly from the area which was attenuated. Littl effect was noted toward the sky—the sun was not seen. A second attempt had little effect as th fog was lifting. (*Same item as* 10.11–131, Nov. 1959, *Met. Abs.*) *Subject Headings:* **1. Artificial fo dissipation 2. Propane fog attenuation 3. Lyon-Bron Airport, France.**—*M.R.*

**11M–724** 551.509.61

O'Mahony, G. (*Central Off., Melbourne*), **Design of cloud seeding experiments.** *Australia Meteorological Magazine*, Melbourne, No. 14:23–40, Sept. **1956.** 8 figs., 7 refs., eqs. **DWB**— Several experiments are being conducted in Australia at present in cloud seeding with silver iodide and the object of this paper is to point out some of the precautions which should be taken whe designing such an experiment and also some of the difficulties which will be encountered in th analysis of results. A summary of a paper by Moran (*see* 11M–629). *Subject Headings:* **1. Clou seeding with silver iodide 2. Cloud seeding evaluation. I. Moran, P. A. P.**—*Author's abstract.*

**11M–725** 551.509.6:0

Orville, Howard T., **Work accomplished to date by the Advisory Committee on Weather Contro** *Western Snow Conference*, 1956, *Proceedings*, 24:33–34, Oct. **1956. DWB** (M06 W527p)—Th progress made in the various phases of weather modification of particular interest to the committe is outlined. The evaluation program of the committee is briefly described. The cloud seedin project **Operation Overseed,** set up at Mt. Washington, New Hampshire is outlined. Finally, th results of the First Interim Report (*see* 11M–753) are listed. *Subject Headings:* **1. U. S. Advisor Committee on Weather Control 2. Operation Overseed 3. Cloud seeding evaluation.**—*I.S.*

**11M–726** 551.509.617:551.574.

Palomares Casado, Manuel, **Producción de precipitaciones atmosféricas por coagulación entr gotas de volumen muy diferente.** [Production of atmospheric precipitation by coagulation betwee drops of very different volume.] *Revista de Geofisica*, Madrid, 15(57):35–43, Jan./March **1956** fig., 6 refs., 5 eqs. Spanish and English summaries p. 35–36. **DWC**—A theoretical study of precipi tation from liquid water drop clouds, for the purpose of determining the feasibility of producin artificial rain by introducing drops that exceed a critical size at a time when the small size of drop or lack of turbulence prevents natural precipitation. The ratio between the size of the drops intro duced into the cloud and the density distribution in the clouds, the distance the drop must travel t reach a given size, time involved, and amount of rain theoretically evoked, are considered on mathematical basis but without concrete numerical examples. (*Same item as* 9.8–146, Aug. 1958 *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with water 2. Drop coagulation.**—*From author' abstract.*

**11M–727** 551.574.2:551.509.617:551.521.1

Picca, Robert, **Nouveaux essais de désactivation de l'iodure d'argent en tant qu'agent glaçogène** [New experiments on the de-activation of silver iodide as an icing agent.] *Académie des Sciences Paris, Comptes Rendus*, 241(4):489–492, Jan. 23, **1956.** 4 foot-refs. **DLC.** Also issued as *Puy-de Dôme. Observatoire, Publications*, No. 2A, **1956. DWB**—A cloud-chamber experiment is describe in which silver iodide nuclei suspended on spider webs were subjected to various treatments and th effect of these treatments on the icing properties of the nuclei was observed. Condensation followe by evaporation totally de-activated 35% of the nuclei, partially de-activated 60% while 5% remaine active. The same figures apply to melting of ice crystals followed by their evaporation. Fo sublimation the number of totally de-activated nuclei is 25%, partially 50%, active 25%. Fo condensation only: total de-activation 15%, partial 35%, active 50%. For melting: partial de activation 60%, active 40%. Placing the de-activated nuclei in a vacuum for one or two hour failed to re-activate them. Under ultraviolet light the active nuclei lost their icing properties afte exposure around 30 min. The author further mentions experiments in which the aging of Ag nuclei was investigated and which showed 90% de-activation after 5 days, 95% after 10 days an total de-activation after 10 to 20 days. (*Same item as* 8.5–252, May 1957, *Met. Abs.*) *Subje Headings:* **1. Silver iodide properties 2. Ultraviolet light effects on nuclei.**—*G.T.*

**11M–728** 551.509.617(675

Pire, J., **Essais de stimulation artificielle de la pluie à Tely (Territoire de Poko, Congo belge) janvier 1955.** [Rainmaking experiments at Tely (Poko territory, Belgian Congo), Jan. 1955. *Académie Royale des Sciences Coloniales, Bulletin des Séances*, N.S., 2(2):230–244, **1956.** 3 figs 6 tables, chart. Introduction by N. Van der Elst, p. 228–229. **DWB**—An analysis of precipitatio

and cloudiness conditions in the eastern part of Uele district, Belgian Congo, suggests that cloud seeding operations in that region would have a good likelihood of making the rainfall distribution more uniform and thus saving coffee crops which need rain during the blooming period. Experiments conducted from Jan. 8 to Jan. 17, 1955 are reported. The two ground-based AgI generators were put into action on two out of the ten days. On these two occasions cloud development was good but precipitation could not be expected with certainty. On both days precipitation was observed in the target area and did not occur upwind of the generators. (*Same item as* 8.4–144, April 1957, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding 2. Belgian Congo.**—*G.T.*

**11M–729** 551.509.617(529)

*Rain Stimulation Research Institute, Taipei, Taiwan, Formosa, **Second report on cloud-seeding experiments over Sun Moon Lake area, 1951–1954.** Issued April **1956.** 22 p. 22 figs., 7 tables. **DWB** (M09.67 R154c)—Cloud seeding experiments in the Sun Moon Lake area have been conducted since Jan. 1951. Airplanes were used up to Nov. 1952 and ground-based AgI generators since that time. Results up to the end of 1952 were published in a first report dated May 1953. This second report covers the dry seasons Nov. 1952–Feb. 1953 and Jan.–March 1954. The results are evaluated by means of a standard method of rainfall correlations between stations in the target and control area (regression lines are presented). An overall increase of 15% during the entire period of operation (1951–1954) is claimed for the target area. Technical details like distribution of generators, timing of operations and laboratory research on seeding agents are discussed (for later report *see* 11M–889). (*Same item as* 9.4–112, April 1958, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding in Formosa 2. Formosa.**—*G.T.*

**11M–730** 551.501.8:551.515.4:551.578.7

Roncali, G., **Sur l'emploi du radar dans la lutte contre la grêle.** [Use of radar in the fight against hail.] *International Union of Geodesy and Geophysics. Association of Meteorology, Rome, Sept.* 1954, *Scientific Proceedings.* London, Butterworth, **1956.** p. 67–68. ref. **DWB**—In 1952, radar of the marine type with a wave length of 3.2 cm was installed at Verona in order to facilitate forecasts of hail producing clouds and to study clouds in relation to hail. Since with the aid of radar it is possible to exclude when the clouds either do not produce echoes or produce only faint ones, the time interval between the first observed echoes and the fall of hail is always more than 30 min at Verona. The result of the development of clouds from which hail has begun to fall is described. (*Same item as* 8.8–127, Aug. 1957, *Met. Abs.*) *Subject Headings:* **1. Radar hail warnings 2. Verona, Italy.**—*I.L.D.*

**11M–731** 551.509.617:551.576.11(44)

*Roulleau, J., **Le contrôle des expériences de pluie provoquée.** [Evaluation of artificial precipitation experiments.] *La Météorologie,* Paris, Ser. 4, No. 44:319–338, Oct./Dec., **1956.** 16 figs., 7 tables. French, English and Spanish summaries p. 319. **DWB**—In order to determine the effectiveness of direct seeding to produce rainfall it is necessary to know the minimum amount of artificial rain produced and the amount of rain produced by an experiment. The answer depends upon a knowledge of the amount of natural rain occurring at a given point or within a given zone; this can be determined either by an analysis of the historical rain data at the given point (comparison in time) or by the rain characteristics of neighboring points (comparison in space). The time comparison method is applied to an analysis of the rainfall at Saint-Maur. Data are presented on annual deviations between successive periods and deviations between alternate periods. On the basis of this analysis it is concluded that the effects of artificial cloud seeding can only be noted if very unusual amounts of additional rainfall are produced. The method of spatial comparison involving experimental and control points is carried out for six zones ranging in area from 1200 km² to 3500 km², using four to eight stations within each zone. An analysis of the temporal variation of rainfall amounts for two zones (1949–1955) and of the influence of distance of comparison zones upon rainfall amounts is presented and the significant amounts of induced rainfall are determined. It is concluded that the comparison of target and control zones seems to be the best method for studying artificially induced rainfall and yields most exact results provided that the choice of zones has been made on the basis of a preliminary climatic analysis. (*Same item as* 10.3–179, March 1959, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding evaluation 2. Rainfall data analysis 3. Saint-Maur, France.**—*I.L.D.*

**11M–732** 551.574.1:551.509.617

Sänger, Raymund (*Physikalisches Inst. der ETH, Zürich*), **On the structure of ice-forming nuclei.** *Zeitschrift für Angewandte Mathematik und Physik,* Basel, 7(3):213–218, May **25, 1956.** 12 refs. German summary p. 217. **DLC.** Also summary in: Conference on the Scientific Basis of Weather Modification Studies, Univ. of Arizona, Tucson, April 1956, **Proceedings,** pub. **1956.** 2 p.—A critical discussion of various opinions on the icing nucleability of different substances, coming to the conclusion that surface forces must be responsible. Epitaxy, as proposed by WEICKMANN,

cannot account for observed facts. WEIGH'S theory of the electrical surface double layer seems to be more applicable. (*Same item as* 8.10–214, Oct. 1957, *Met. Abs.*) *Subject Headings:* **1. Icing nucleability 2. Artificial precipitation.**—*A.A.*

**11M–733** 551.509.617

Sakanoue, T. (*Kyushu Univ., Met. Lab.*), **The experiments of the artificial production of "Rauhfrost."** *Journal of Agricultural Meteorology*, Tokyo, 11(4):143–146, March **1956.** 6 figs. (incl. photos.), table, 3 refs. In Japanese; English summary p. 146. **DWB**—As a fundamental experiment for rain-making, seeding experiments in a chamber filled with supercooled droplets were repeatedly done at various laboratories. Similar experiments in the outdoor field were scanty in number. The author studied with good success the outdoor experiment at Mt. Unzen in winter of 1953, using silver iodide (AgI), according to H. G. HOUGTON'S theory by producing silver iodide particles in the supercooled clouds and thereby making sure of growth of ice crystallization. This agent was fired at the lee side of Mt. Unzen at Nita when the atmospheric condition was good for the development of "Rauhfrost." In order to measure the quantity of "Rauhfrost" the author used nets made of thin wire. The distribution of deposited rauhfrost appears to indicate that seeding by silver iodide can be effective under the proper atmospheric conditions. *Subject Headings:* **1. Cloud seeding with silver iodide 2. Artificial rime formation.**—*From author's abstract.*

**11M–734** 551.509.617:551.521.17

Sano, I. and Fukuta, N. (*both, Chem. Inst., Nagoya Univ.*), **Effects of water vapour, ammonia and hydrogen sulfide against the decay of silver iodide smoke under irradiation of ultraviolet light.** *Meteorological Society of Japan, Tokyo, Journal*, Ser. 2, 34(1):34–40, March **1956.** 10 figs., 3 tables, 10 refs., 4 eqs. In Japanese; English summary p. 34–35. **DWB, DLC**—Smoke chamber experiments aimed at studying the decay rate of ice-forming properties of silver iodide particles under ultraviolet irradiation are reported. Water vapor, ammonia and hydrogen sulfide were all found to be effective in preserving nucleating properties of AgI against decay due to ultraviolet radiation. The possible mechanisms of this protective action were also investigated and are discussed. (*Same item as* 10.5–197, May 1959, *Met. Abs.*) *Subject Headings:* **1. Silver iodide decay 2. Ultraviolet light effects on nuclei.**—*G.T.*

**11M–735** 551.509.617(52)

Sano, I.; Fujitani, Y.; Ito, K. and Kitani, S. (*Chem. Inst., Faculty of Science, Nagoya Univ.*), **A field experiment of snow-making by seeding with nickel oxide.** *Meteorological Society of Japan, Tokyo, Journal, Ser.* 2, 34(4):185–189, Aug. **1956.** 2 figs., 2 tables, 9 refs. **DWB, DLC**—Nickel oxide has, next to silver iodide, an excellent ice-nucleating ability (nucleation temperature, −7°C). With the intention of testing its practical applicability to rain-making, we have performed a field experiment from Jan. 27 to Feb. 4, 1956 on the outskirts of Takayama City, Gifu Prefecture. Nickel oxide was prepared through thermal decomposition of the carbonate, and the powder obtained was sent up, after thorough pulverization, into the sky by a dust-ejector. We have succeeded in deriving snow from the atmosphere at temperatures as low as −12° to −16°C, but never experienced, as expected, any appreciable snow-fall when the air temperature was higher than −7°C. In order to seek the diffusion of the nickel oxide smoke in the atmosphere, we have, keeping pace with the progress of experiment, tried detecting nickel oxide in the air around the seeding-station by a dimethyl glyoxime indicator method. The ice crystals, whose formation is considered to be due to the seeding, were fixed to replicas; they were classified according to their shape to plate-like, columnar, stellar, dendritic and so on; the size of the plate crystals was measured in particular and it was found to range from 30 to 210$\mu$ in diameter. (*Same item as* 9.5–127, May 1958, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with nickel oxide 2. Cloud seeding in Japan.**—*Authors' abstract.*

**11M–736** 551.574.1:551.508.91

Sano, I. and Fukuta, N. (*Chemical Inst., Faculty of Science, Nagoya Univ.*), **Observations of the ice-nucleating temperature of some chemical substances.** *Meteorological Society of Japan, Tokyo, Journal*, Ser. 2, 34(5):293–295, Oct. **1956.** 2 figs., 8 refs. **DWB, DLC**—In order to get a clue to the relation among the ice-nucleating activity of substances and their crystal structure, solubility and other properties, a thermostat-like cold-chamber functioning at any temperature higher than −20°C has been constructed and about 30 materials—oxides of cobalt, nickel, cadmium, magnesium and zinc, halides of alkali and alkaline earth metals and of silver, lead, cadmium sulfide, magnesium telluride, etc. belonging to either the cubic or hexagonal system have been examined as to the temperature of ice crystal formation. The main findings are as follows: 1) The more closely the lattice constant approximates that of ice, and the more definite the insolubleness in water, the more likely the substances, both cubic and hexagonal, are to exhibit a marked ice-forming property; 2) Lead

iodide and silver iodide are the most effective of the substances examined, the ice crystals being found to form from supercooled clouds at −2.3° and −2.9°C, respectively, in the presence of these foreign nuclei. (*Same item as* 9.8–215, Aug. 1958, *Met. Abs.*) *Subject Headings:* **1. Nuclei effectiveness 2. Cloud chamber studies.**—*Author's abstract.*

**11M–737** 551.509.617

†Schaefer, Vincent J., **Artificially induced precipitation and its potentialities.** (In: International Symposium on Man's Role in Changing the Face of the Earth, Princeton, N. J., June 1955, [**Proceedings**], ed. by W. L. Thomas, Jr. Univ. of Chicago Press, **1956.** p. 607–618. Bibliog. p. 617–618.) **DLC** (G56.I63)—The author briefly discusses the events leading to the discovery that dry ice and AgI can act to induce artificial precipitation and then considers various techniques used in weather forecasting and their inadequacies, the importance to weather forecasting of more extensive knowledge on the concentration and type of condensation nuclei present in the atmosphere, the temperature conditions associated with ice-crystal nuclei formations of various types with formation of cirrus clouds, etc., the production of nuclei by dry ice and AgI, etc., formation of coalescence rainfall, the formation of rain and hail from clouds below 0°C level, the objectives and results of Project Cirrus, cloud seeding operations outside the U. S., the results of large scale seeding activities as reported by ELLIOTT and STRICKLER, research on the modification of storms by cloud seeding, etc. (*Same item as* 9.8–149, Aug. 1958, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Cloud seeding 3. Project Cirrus 4. Cloud seeding effectiveness.**—*I.L.D.*

**11M–738** 551.509.615:551.575:551.578.41

Schaefer, Vincent J. (*Munitalp Foundation, Inc.*), **Production of a diamond dust shower. (Simple experiments in atmospheric physics, Pt. 7).** *Weatherwise*, Boston, 9(6):195–197, Dec. **1956.** fig., 2 photos. **DWB**—Instructions for an experiment in natural seeding of a supercooled fog area in a valley just at sunrise or before, by using a chunk of dry ice ($CO_2$) suspended in a bag and swinging the bag through the supercooled fog when conditions are ideal (0° to −5°C). The patches of ice fog thus produced may expand and change form after sunrise. The clouds are composed of "diamond dust" snow crystals. *Subject Headings:* **1. Dry ice seeding of supercooled fog 2. Artificial production of snow crystals in nature.**—*M.R.*

**11M–739** 551.509.617

†Schaefer, Vincent J. (*Munitalp Foundation, Inc., Schenectady, N. Y.*), **Some relationships of experimental meteorology to arid land water sources.** (In: White, Gilbert F. (*ed.*), **The future of arid lands.** Wash., D. C., *American Association for the Advancement of Science, Wash., D. C., Publication*, No. 43, pub. **1956.** p. 300–313. table, 32 refs.) **DLC.** Also issued as: *The Munitalp Foundation, Inc., Occasional Papers*, No. 0018, **1956.**—On the basis of an extensive review of the literature on induced rainfall, the author discusses, with special reference to the production in arid regions, the following pertinent subjects: variations in concentration of ice nuclei, importance of ice nuclei in controlling precipitation, importance of ice nuclei in regions like New Mexico, precipitation patterns resulting from orographic clouds in New Mexico, movement of air in valley bounded by mountain, effectiveness of AgI as a nucleus for ice crystal formations and future prospects for increased water supply from the atmosphere. (*Same item as* 9.5–128, May 1958, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding potentialities 2. Cloud seeding in arid lands.**—*I.L.D.*

**11M–740** 551.509.616

Scorer, R. S., **The man who dissolved clouds.** *Weather*, London, 11(10):319–322, Oct. **1956.** fig. **DWB**—An amusing article about Rolf Alexander who claimed to dissolve clouds by staring at them but failed in a test. It is illustrated by 11 photos of small fair weather cumulus at 1½ min intervals. (For comment by Alexander and reply by Scorer *see* 11M–684.) (*Same item as* 8.2–221, Feb. 1957, *Met. Abs.*) *Subject Heading:* **1. Artificial cloud dispersal.**—*C.E.P.B.*

**11M–741** 551.509.617:551.510.42:551.574.1

Serpolay, R. (*C. N. R. S., Obs. du Puy de Dôme*), **Propriétés glaçogènes des aérosols produits par la volatilisation des métaux.** [Icing properties of aerosols produced by volatilization of metals.] *Puy de Dôme. Observatoire, Bulletin*, Ser. 2, No. 3:86–87, July/Sept. **1956.** 2 refs. **DWB**—Note on the volatilization of metallic filaments (Ag, Al, Cr, Cu, Fe, Mo, Ni, Pb, Sn) and the nucleating properties of these volatile particles when they are introduced into supercooled clouds. They all seem to produce freezing at temps. above the spontaneous freezing temp. of clouds—at −16°C large numbers of ice crystals form in presence of these particles and at −7°C or −10°C when Ag or Al is present. Meteoritic dust may contain such volatile iron products as would produce freezing at higher temps. than normal. (*Same item as* 10.5–198, May 1959, *Met. Abs.*) *Subject Headings:* **1. Nucleation by volatile metallic particles 2. Meteoric dust nucleation.**—*M.R.*

**11M–742** 551.509.617(763)

Shope, Harlan D., **Experience with artifical rainmaking.** *Louisiana. Engineering Experiment Station, Bulletin*, No. 55:10–11, **1956.** 5 figs., table. **DA** (290.0 L9312B)—Brief comments on natural and artificial rainmaking mechanisms, based on work done by the International Paper Company Southern Kraft Division, Mobile, Alabama, under contract with Wallace E. Howell Associates, at Moss Point, Mississippi and Georgetown, South Carolina in the fall and winter 1954–55. Experiments resulted in increased rainfall and runoff, and control of forest fires. A table shows daily average and peak values of the effects of salt water intrusion at Moss Point mill August 1, 1954 to March 1, 1955. Four charts and a diagram relate to variations of the percentage of normal rainfall at Escatawpa Watershed Project in the 1954 part of this period. *Subject Headings:* **1. Cloud seeding effects 2. Louisiana.**—*O.T.*

**11M–743** 551.509.617(946)

Smith, E. J. and Heffernan, K. J., **The decay of the ice-nucleating properties of silver iodide released from a mountain top.** *Royal Meteorological Society, Quarterly Journal*, 82(353):301–309, July **1956.** 3 figs., 6 tables, 9 refs. **DWB**—Silver iodide smoke generators (kerosene and hydrogen) were mounted on top of Mt. Wellington, Tasmania (1300 m) and zinc sulfide tracer was dispensed by a dry duster. Distribution was checked by airplane which also took temperature soundings. Freezing nuclei decayed rapidly during daylight but not at night. Rate of decay was not affected by temperature. The width of the smoke plume was about 5 km at 12 km distance and 10 km at 40 km, about half that of plumes released from flat ground. The plumes rose no higher than when released from low ground, the top when measured being at 1200-1800 m. (*Same item as* 8.2–102, Feb. 1957, *Met. Abs.*) *Subject Headings:* **1. Silver iodide decay 2. Mt. Wellington, Tasmania.**—*C.E.P.B.*

**11M–744** 551.509.617:551.574.2:546.57:546.15

†Solov'ev, A. D., **Metody iskusstvennogo obrazovaniia ledianykh chastits v pereokhlazhdennykh oblakakh.** [Methods for the artificial formation of ice particles in supercooled clouds.] *Moscow. Tsentral'naia Aerologicheskaia Observatoriia, Trudy*, No. 17:57–70, **1956.** 49 refs., 2 figs. **DLC**—A review of the non-Russian literature on the formation of ice crystals in clouds by ice seeding and by the use of AgI, on the methods of use of AgI and on the artificial production of rain. (*Same item as* 10.8–176, Aug. 1959, *Met. Abs.*) *Subject Headings:* **1. Ice crystal formation 2. Cloud seeding with silver iodide.**—*I.L.D.*

**11M–745** 551.509.6

Spilhaus, Athelstan, **Control of the world environment.** *Geographical Review, N. Y.*, 46(4): 451–459, Oct. **1956.** 2 foot-refs. **DWB, DLC**—In this general discussion of man's need and ability to control his environment in order to satisfy increasing requirements for food, shelter, etc., the author touches on the use of controlled atmospheric and hydrologic cycle for plant production under greenhouse conditions and in deserts for example, the utilization of the fresh water of polar regions in areas of water shortage but with suitable heat and light conditions, the use of solar energy, the artificial production of rainfall, the disruption of hurricanes, etc. (*Same item as* 9.10–146, Oct. 1958, *Met. Abs.*) *Subject Heading:* **1. Weather control.**—*I.L.D.*

**11M–746** 551.509.617(52)

Sugawara, K. (*Chemical Inst., Nagoya Univ.*), **Brief account of the research activities in the field of rain and snow making in Chubu District during the period from April 1954 to Feb. 1956.** *Papers in Meteorology and Geophysics*, Tokyo, 7(3):336–339, Oct. **1956.** 3 refs. **DWB**—The basic research was conducted in the laboratory of K. SUGAWARA and that of I. SANO at Nagoya University, while field experiments were conducted with the cooperation of the Chubu Electric Power Co., the Tokyo District Meteorological Observatory, the Nagoya Local Meteorological Observatory, the Meteorological Research Institute and Nagoya University. (*Same item as* 9.9–147, Sept. 1958, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Japan 2. Chubu District, Japan.**—*Author's abstract.*

**11M–747** 551.509.616:551.576.11(47)

Suprunenko, P., **Upravlinnia khmarami,** [Cloud modification.] *Ukraina*, Kiev, No. 23(182): 15, **1956. DLC**—A simply written account of the development of artificial rainmaking in the U.S.S.R. in which the author recounts how MIROSHNICHENKO, a teacher and an amateur physicist, developed gradually into a rainmaking specialist, organized a laboratory of "cloud physics" in his school at Zaporozhe, and invented a new spray for seeding clouds. During his study, he obtained the following data: in 1 $cm^3$ of cloud there are usually 120,000 droplets; after treating the cloud with his spray the number of drops is reduced to 80,000. This means that the droplets coalesced, grew and became raindrops. If sprayed with another preparation, the number of drops increases, but they

become smaller, and the cloud dissolves. Experiments are being continued. (*Same item as* 10.6–159, June 1959, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in U.S.S.R. 2. Cloud seeding techniques 3. Zaporozhe, U.S.S.R.**—*A.M.P.*

**11M–748** 551.509.617:551.574.1:551.573:551.578.11

Sutcliffe, R. C., **Rain: natural and artificial.** *British Journal of Applied Physics*, 7(3):85–88, March **1956.** 7 refs. **DLC**—Mean annual rainfall over the globe is about 90 cm and some 20% of sun's radiation energy is used to evaporate this amount. Vertical and horizontal transport of water vapor, formation of rain clouds, and instability are discussed generally; attack by mathematical physics is imminent. Nuclei provide for condensation as cloud particles. Coagulation to form rain has critical features which might permit artificial control, but there is as yet no convincing evidence of the economic usefulness of the seeding methods hitherto tried. Various other possibilities are discussed. (*Same item as* 7.11-147, Nov. 1956, *Met. Abs.*) *Subject Headings:* **1. Precipitation mechanism 2. Artificial precipitation.**—*C.E.P.B.*

**11M–749** 551.509.617:551.578.7(494)

*Switzerland. Eidg. Kommission zum Studium der Hagelbildung und Hagelabwehr, **Grossversuch II zur Bekämpfung des Hagels auf der Magadinoebene, 3. Versuchsjahr.** [Project 2 for Hail Control in the Magadino Plain, 3rd year of experiment.] Its *Tätigkeitsbericht*, No. 8, 1955, pub. **1956.** 51 p. 17 figs., tables. **DWB**—In an arrangement similar to that of the reports on the 1st and 2nd seasons (*see* 11M–657), this report contains a detailed account of the third season of operation in the hail control experiments conducted by the Swiss Commission for the Study of Hail Formation and Hail Prevention. The ten automatic ground-based silver iodide generators were distributed as before over the Magadino Plain (locations shown in map) and operated according to necessity during thunderstorms. Organization and operation of the seeding network, weather development and data on thunderstorms and hailstorms during the season (May 16–Oct. 10, 1955) and amounts of hail damage are discussed. For each instance of seeding a report of action is included, giving date, time of operation, generators in action, aerological data (including height of the −4°C isotherm), a map showing thunderstorm trajectories (classified as warm-front, cold-front or local thunderstorms) and miscellaneous comments. In summing up the results of the season the authors conclude that a statistical evaluation cannot be undertaken because this would require (no control area being available) a much longer series of operations than that obtained so far. Only qualitative conclusions may be drawn at this point. Out of the 69 days with thunderstorms, seeding took place on 37 days. Hail fell on 14 out of these 37 days in some part of the entire area of observation. In the seeding area (with or without seeding) there were ten days with hail. After eliminating thunderstorms with no hail, and hailstorms for which seeding was started too late, there remain four instances in which hail fell in the seeded area. In these cases the weather situation was such that the seeding agent is not likely to have reached the area of hail formation at the proper time. The same seeding network is to be used in the following season (for later reports *see* 11M–830, –897, –960 and -1011). (*Same item as* 8.7–24, July 1957. *Met. Abs.*) *Subject Headings:* **1. Hail prevention in Switzerland 2. Cloud seeding with silver iodide 3. Magadino Plain, Switzerland. I. Sänger, R. II. Staub, H. III. Thams, J. C.**—*G.T.*

**11M–750** 551.509.617(52)

Takeda, K. and Sakanoue, T. (*both, Met. Inst. Kyushu Univ.*), **Researches on rain-making in Kyushu Area 1954–1956.** *Papers in Meteorology and Geophysics*, Tokyo, 7(3):342–346, Oct. **1956.** 3 figs. (photos), table. **DWB**—A report of three experimental rain-making techniques tested during 1954–1956 by the members of Kyushu University in cooperation with the Kyushu Electric Company. The three methods consist of: 1) release of AgI from balloons, 2) from generators on the earth's surface and 3) dropping of dry ice pellets from an airplane. Each method is described and the results obtained therefrom are discussed. Photographs showing cloud seeding in different months nicely illustrate the discussion. *Subject Headings:* **1. Cloud seeding research 2. Cloud seeding techniques 3. Kyushu, Japan.**—*I.S.*

**11M–751** 551.509.617(642)

Tapia Contreras, José, **Estimulación artificial de la lluvia en el nordeste de Marruecos (Segunda campaña, Oct. 1954–Mayo 1955).** [Artificial stimulation of rain in Northeast Morocco: second season, Oct. 1954-May 1955.] *Spain. Servicio Meteorológico Nacional, Publicaciones, Ser. A. (Memorias)*, No. 27, **1956.** 53 p. graphs. **DLC**—Experiments with silver iodide seeding in southern Spain and northeast Morocco during March–May 1954 (and earlier tests since Jan. 1953 in the eastern part of the French Protectorate), were continued from Oct. 1954–May 1955, using 18 generators. Day-by-day weather conditions, operations and results are discussed and presented on handsome isohyetal charts (showing relief), and in graphs. Although the presentation is quite complete and the "conclusions" extensive, the only real firm result was the conviction that seeding

is more valuable for provoking additional precipitation than for originating precipitation. (*Same item as* 11.9–236, Sept. 1960, *Met. Abs.*). *Subject Headings:* **1. Cloud seeding in Spain 2. Cloud seeding with silver iodide 3. Spanish Morocco.**—*M.R.*

**11M–752** 551.574.1:551.509.617

Toye, M. J. (*Obs. du Puy de Dôme*), **Dessiccation de gouttelettes d'une solution de chlorure de sodium.** [Drying of droplets of a sodium chloride solution.] *Puy de Dôme. Observatoire, Bulletin*, Ser. 2, No. 3:71–77, July/Sept. **1956.** 4 figs., 5 refs. **DWB**—The smaller the diameter of a droplet of pure saline solution (NaCl) placed in an atmosphere with decreasing relative humidity, the more difficult becomes the crystallization of the salt in supersaturation. Thus at <50% relative humidity, the only drops remaining in solution are the very small ones. These were visible with a 40 power microscope but did not appear in the photographic experiments (with lower resolution) since no drop size-relative humidity relationship could be found except in the critical low limits. An introduction of pollution crystals of AgCl tended to cause crystallization by epitaxy at a higher relative humidity. This may explain the quicker crystallization of the larger droplets (which are more likely to be struck by a small polluting crystal than are the small droplets). (*Same item as* 10.1–285, Jan. 1959, *Met. Abs.*) *Subject Headings:* **1. Humidity-crystallization relationships 2. Desiccation of sodium chloride droplets 3. Epitaxy 4. Crystallization point of sodium chloride solutions 5. Silver iodide nucleation 6. Silver chloride nucleation.**—*M.R.*

**11M–753** 551.509.617

U. S. Advisory Committee on Weather Control, **First interim report.** Wash., D. C., Feb. **1956.** 11 p. **DWB** (M09.6 U582i)—A summary of the authorization, the tasks and tentative conclusions with respect to the present and future possibilities of rain making. Economically important results of cloud seeding are claimed for the West Coast area (9–17% increase) and that AgI particles do not become deactivated in bright sunshine for at least 45 min. (a testing project was established on and near Mt. Washington, N. H.). Basic research is to be encouraged and a 2-yr program of statistical evaluation undertaken. Hail and lightning suppression should be studied. (*Same item as* 9.6–135, June 1958, *Met. Abs.*) *Subject Headings:* **1. U. S. Advisory Committee on Weather Control 2. Cloud seeding evaluation.**—*M.R.*

**11M–754** 551.574.2:551.509.612

Warner, J. and Bigg, E. K. (*both, Div. of Radiophysics, C. S. I. R. O., Australia*), **Effects of air temperature and pressure on the decay of silver iodide.** *American Meteorological Society, Bulletin*, 37(3):94–95, March **1956.** 2 figs., 3 refs. **DWB**—Bolton and Qureshi's laboratory experiments on the decay of silver iodide smokes were repeated and it was shown that for dilute smokes the deterioration was very slight and there was no important temperature effect. It is concluded that the coagulation of concentrated smokes used was responsible for the high rates of decay they observed at warm temperatures. (*Same item as* 8.4–262, April 1957, *Met. Abs.*) *Subject Heading:* **1. Silver iodide properties.**—*Authors' abstract.*

**11M–755** 551.509.617:551.574.2:629.135

Warner, J. and Twomey, S. (*Div. of Radiophysics, C. S. I. R. O., Australia*), **The use of silver iodide for seeding individual clouds.** *Tellus*, Stockholm, 8(4):453–459, Nov. **1956.** 3 figs., table, ref. **DLC**—The results of seeding thirty-five supercooled clouds, mostly cumuliform, in southeastern New South Wales, 100 mi inland, are described. The silver iodide was released as a smoke from aircraft flying through the upper levels of the cloud or just below cloud base. It is concluded that silver iodide is an effective agent in inducing precipitation in clouds whose upper levels are at temperatures colder than −5°C, and that the precipitation is usually released 20 to 25 min after seeding in the case of cumulus clouds but later in the case of layer clouds. (*Same item as* 8.8–178, Aug. 1957, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding effectiveness 2. Cloud seeding from airplane 3. Silver iodide from aircraft 4. New South Wales, Australia.**—*Author's abstract.*

**11M–756** 551.583 551.509.6

**Our mad weather: what the scientists are doing about it.** *Newsweek*, N. Y., 58(11):61–66, Sept. 10, **1956.** 2 figs., 2 photos. **DLC**—Popular summary of recent activities, progress and opinions on climatic changes, weather control, hurricane warning and modification, tornado warning and reconnaissance and drought. Causes of climatic changes were laid to volcanic dust, sunspots, etc. but new information gathered during IGY may provide a better answer. One chart shows course of 1954–55 hurricanes from West Indies to St. Lawrence and another shows 50-year temperature changes in 8 sections of U. S. for summer and winter. Warming is mostly in E. and S. and in winter; cooling has occurred in summer of past 3 decades in West and Northwest. (*Same item as* 9.7–252, July 1958, *Met. Abs.*) *Subject Headings:* **1. Climatic changes 2. Weather control.**—*M.R.*

**11M–757** 551.509.617(678.2)

**Rain-making in Tanganyika,** *Nature,* London, 177(4522):1204, June 30, **1956. DWB**—Note of a statement by LENNOX-BOYD in Parliament of cloud-seeding by 2″ rockets incorporating particles of sea salt, bursting at 3000 ft. Rain repeatedly occurred 12 min after seeding. In April the seeded area had 1 1½″ more than neighboring regions. (*Same item as* 7.10–112, Oct. 1956, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with salt 2. Tanganyika.**—*C.E.P.B.*

## 1957

**11M–758** 551.509.61

Ackerman, Edward A., **Design study for economic analysis of weather modification.** [In: U. S. Advisory Committee on Weather Control, **Final Report, 1957.** 2:235–245. fig. (fold. map), 15 refs.] **DWB, DLC**—After considering the single purpose type of appraisal of the results of weather modification, the author presents the reasons for the need of economic analysis from a public point of view, namely the wide territorial scope of weather modification, the harmful results that may accompany the benefits derived from weather modification, the size of the expected U. S. population and its future distribution, etc. This is followed by an analysis of the design of studies treating the economic effects of weather modification and an outline of the desirable objectives of an economic study. Such studies are to be made in the light of three distinct levels of possible weather control, namely: (1) the economics of near future practical application of weather modification; (2) the economic opportunity for the application of known techniques and (3) near future practical applications. The possible procedures in carrying out economic studies on these three levels of weather modification possibilities are presented in considerable detail. The determination of costs; pilot study of "disbenefits"; quantitative evaluation of the complex of water affected economic pursuits of a given area the assumptions underlying a study; availability of data for studying economic opportunity for weather modification; the economic implications of diverting, phasing or otherwise altering continental air masses; the possible economic aspects of now speculative but potentially revolutionary weather modification studies, etc. (*Same item as* 10.3–175, March 1959, *Met. Abs.*) *Subject Headings:* **1. Economic aspects of weather modification.**—*I.L.D.*

**11M–759** 551.509.617:546.57:546.15(94)

Adderley, E. E. and Twomey, S. (*both, Div. of Radiophysics, C. S. I. R. O., Sydney, Australia*), **An experiment on artificial stimulation of precipitation in the Snowy Mountains region of Australia.** (In: U. S. Advisory Committee on Weather Control, Final Report, **1957.** 2:291–295. 5 figs., ref.) **DWB, DLC.** Also in: *Tellus,* Stockholm, 10(2):275–280, May **1958.** 5 figs., table, ref. **DLC**—A report on a long term experiment on artificial rain production by AgI cloud seeding being carried out in Australia jointly by the Snowy Mountains Hydroelectric Authority and the Commonwealth Scientific and Industrial Research Organization in June 1955. The method of control for comparing seeded and unseeded areas involved the use of random periods for seeding. In the light of circulation conditions over southeast Australia where the pressure system from west to east has an average period of 6 to 7 days, the period of seeding had to be not less than 8 days. The estimation of precipitation, the area of operation, (shown on maps) and the AgI smoke generator (illustrated by a diagram) are described and the operational procedure is outlined. The results, presented in a table and graph, the ratios of cumulative sums of the precipitation in the target and control areas, indicate that the ratios of target area to control area precipitation are greater during the seeded periods but the number of observations is far too inadequate to determine whether there is an effect due to the seeding program. (*Same item as* 10.9–174, Sept. 1959, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Cloud seeding with silver iodide 3. Snowy Mts., Australia.**—*I.L.D.*

**11M–760** 551.509.617

American Meteorological Society, **Statement on weather modification,** Its: *Bulletin,* 38(6):366, June **1957. DWB, DLC.** Also review by R. Bilancini in *Rivista di Meteorologia Aeronautica,* Rome, 18(1):49, **1958. DLC**—The Council of AMS issued a statement on weather modification in 1951 and 1953 for the latter (*see* 11M–393). A revised statement approved in April 1957 is presented. The 9 points covered include: 1) effectiveness of dry ice seeding of supercooled clouds; 2) of water seeding; 3) fog dissipation; 4) AgI seeding; 5) need for active source of moisture or clouds; 6) ground based AgI successes; 7) randomized experiments essential for evaluation; 8) no evidence of large scale modification possibilities; 9) all attempts must be considered experimental and conducted as scientific experiments. As usual, a note of cautious optimism is expressed throughout the statement. *Subject Headings:* **1. Weather control 2. Cloud seeding.**—*M.R.*

**11M–761** 551.509.616

aufm Kampe, H. J.; Kelly, J. J. and Weickmann, H. K. (*all, Signal Corps Engineering Labs.*), **Seeding experiments in subcooled stratus clouds.** *Meteorological Monographs,* Boston, 2(11):86–111,

July 1957. 34 figs. **DWB, DLC**—Seeding experiments with dry ice and silver iodide are described. The experiments indicate that it is possible to dissipate large cloud areas by seeding them with dry ice if the temperature is below approximately −4°C and the cloud decks are stable. For successful silver iodide seedings, the cloud temperature should be around −10°C and the seeding rate should be of the order of 100 gm AgI per mile. (*Same item as* 10.11–128, Nov. 1959, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding experiments 2. Cloud seeding with dry ice 3. Cloud seeding with silver iodide.**—*Authors' abstract.*

**11M–762** 551.594.22:551.509.616:632.187

†Barrows, J. S. et al., **Project Skyfire.** (In: U. S. Advisory Committee on Weather Control, **Final Report, 1957.** 2:105–125. 20 figs., 4 tables, 19 refs.) **DWB, DLC**—The results of experiments carried out to suppress lightning fires in forests by using cloud modification, either to prevent or reduce the severity of fires, are presented in this comprehensive report. The contents of this study are as follows: the lightning fire problem in American forests; the organization of the research program of "Operation Skyfire"; a discussion of the theoretical aspects of lightning suppression, including a consideration of the apparent meteorological processes involved in thunderstorm electrification; the relationship between thunderstorms and cloud seeding and possible methods of lightning suppression; the procedure and results of the cloud and lightning survey carried out prior to the experimentation with cloud seeding (network of lookout stations, cloud breeding areas, lightning storm paths and types); description of the procedures and results of preliminary cloud seeding research carried out in Arizona in 1956, and Northern Rockies in 1956; and a detailed account of the 1957 Project Skyfire Cloud Seeding Experiment carried out on the Lolo National Forest southwest of Missoula, Mont. The results of the seeding are as follows: glaciation occurred in both small and towering cumulus clouds whenever the clouds were colder than −4°C and the AgI crustals entered the cloud. The growth rate and structure of towering cumulus with major portions below −4°C were altered; virga appeared, precipitation was produced and in isolated instances lightning occurred. The life and concentration of AgI was analyzed. Data on lightning occurrence in 1957, Project Skyfire test area, a summary of the seeding operations of this project, numerous photographs of cloud phenomena, equipment procedure, etc. are presented. (*Same item as* 10.3–90, March 1959, *Met. Abs.*) *Subject Headings:* **1. Project Skyfire 2. Forest fire control 3. Lightning fires 4. Cloud seeding.**—*I.L.D.*

**11M–763** 551.509.615:551.575

Bashkirova, G. M. and Krasikov, P. N., **Opyty po izucheniiu nekotorykh veshchestv v kachestve reagentov kristallizatsii pereokhlazhdennogo tumana.** [Experiments with certain substances as crystallization agents for supercooled fog.] *Leningrad. Glavnaia Geofizicheskaia Observatoriia, Trudy*, 72:118–126, **1957.** 7 figs., 7 tables, 7 refs. **DLC**—The methods and results of such experiments carried out in a 250-liter refrigerating chamber, with the following substances—cadmium oxide, zinc oxide, silver iodide, iron sulfide, fluoroglycine, silver dioxide, gasoline tank deposits, and magnesium oxide—are described and discussed. It is shown that silver iodide is the most effective of all agents. Properties of the other agents mentioned are also presented. Photos of ice crystals formed at the introduction of these various agents into fog are included. (*Same item as* 10.4–142, April 1959, *Met. Abs.*) *Subject Headings:* **1. Artificial fog 2. Nuclei sources 3. Silver iodide effectiveness.**—*A.M.P.*

**11M–764** 551.509.616:551.574.1:576.11

Battan, Louis J. (*Univ. of Chicago*) and Kassander, A. Richard, (*Univ. of Arizona*), **Randomized seeding of orographic cumulus, 1957, Pt. 1.** Chicago. Univ. Dept. of Meteorology, Cloud Physics Lab. Contract AF 19(604)-1388, Technical Note, No. 12, Feb. 15, **1958.** 17 p. 4 figs. (incl. photo), 3 tables, 3 refs. Battan, L. J.; Kassander, A. R. and Sims, Lee L., **Pt. 2.** *Ibid.*, Scientific Report No. 9, Oct. 1, **1958.** 11 p. 4 figs., 10 refs. Battan, L. J. and Kassander, A. R., **Pt. 3.** *Ibid.*, Contract AF 19(604)-1388, Technical Note No. 15, June 1, **1958.** 11 p. 5 figs., 2 tables, 4 refs. **DWB** (M74.1 C532ten). During July and August 1957, orographic cumuli above the Santa Catalina Mts. of southeastern Arizona were seeded from an airplane with AgI. The experimental design of the program involved the randomized seeding by pairs of days; one of two days with suitable clouds was seeded on a random basis. 16 pairs of days were studied. On seven pairs of days, observations were made of the cumuli with a pair of K-17 cameras on a 1.3 mi baseleg. On 14 pairs of days observations of the formation and spread of precipitation were made with a 3 cm height finding radar. On the basis of the analysis of the camera and radar observations an investigation has been made of the occurrence of precipitation as a function of cloud size and temperature. It was found that there is a large variability in cloud behavior from year to year. Natural clouds in the arid southwest do not produce precipitation until their vertical thicknesses are of the order of at least 8 to 10,000 feet. It appears that seeding caused some changes in the precipitation processes. On the seeded days, the initial echoes were, on the average, at a higher altitude (and lower tempera-

ture) and high rates of growth of the echo were more frequent than on the nonseeded days. The observed differences are not significant statistically. However they indicate the wisdom of continuing the program for at least one more year, as has already been planned. (*Same item as* 10.6–156, –157 and 10.7–176, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding of orographic clouds 2. Cloud seeding with silver iodide 3. Cloud seeding evaluation 4. Santa Catalina Mountains, Ariz.**—*From authors' abstracts.*

**11M–765** 551.509.617(783)

Berndt, Gerald D., **Evaluation of commercial cloud seeding operations conducted during the summer months in South Dakota.** (In: U. S. Advisory Committee on Weather Control, **Final Report, 1957,** pub. **1957.** 2:69–80, 5 figs., 9 tables, 16 refs., 13 eqs.) Reprinted from *U. S. Advisory Committee on Weather Control, Technical Report,* No. 5. **DWB, DLC**—The statistical methodology for evaluating the effect of summer time cloud seeding operations in South Dakota upon the rainfall in this area is presented. The author discusses the suitability of the rainfall data available for the target and control area, prior to the initiation of seeding operations, and the lack of physical evidence on the frequency of supercooled clouds over South Dakota during the summer months, on the accuracy of "targeting" the seeding, on the actual penetration of AgI nuclei into the clouds, etc. The rainfall variable, which consists of the rainfall records of the five target stations for the summer months of 1926–1950 and 1951–54, is analyzed for statistical independence and for trend, and the distribution of rainfall amounts is found to be represented adequately by the gamma distribution. The possibility of determining whether rainfall has been increased by cloud seeding is analyzed by means of a fixed sample-size test and by sequential analysis; and it is shown that for the number of storms seeded neither of these tests is sufficient to detect rather small but important increases in rainfall. To make use of the information available in the data of four years of seeding operations, a form of decision theory using the Bayes procedure is used. "On the premise that some decision to seed or not may be based upon the information of this evaluation, the idea of consequent average loss, or risk, is discussed for various possible eventualities." The more usual test of significance is compared with the Bayes procedure and it is shown in an illustration that both may lead to erroneous decisions and hence economic loss. The maximum risk over all possible seeding effects is shown to be less for the Bayes procedure. Application of the Bayes procedure to the seeded South Dakota storms gives preliminary indications that there is less risk in choosing to seed in May, June and Aug. but not July, than in taking the alternative course of action in those months. (*Same item as* 10.4–145, April 1959, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding 2. Cloud seeding evaluation 3. Bayes procedure 4. South Dakota.**—*I.L.D.*

**11M–766** 551.509.616

Berndt, Gerald D., **Summary of the statistical evaluations by the Advisory Committee.** (In: U. S. Advisory Committee on Weather Control, **Final Report, 1957,** pub **1957.** 2:92–96.) **DWB, DLC**—The author reviews in nontechnical terms the results of the statistical evaluation of the effects of cloud seeding operations analyzed by the Advisory Committee on Weather Control. The physical data were obtained during 12 different cloud seeding projects and embraced 427 storms. The collection of the data for the periods preceding the experimental cloud seeding and the observations recorded during the operations are described in a general way. A general description is presented of the methods of evaluating the results of cloud seeding, including the determination of the normal precipitation over a given period at the operational area, use of replication and regression equations, the classification of the cloud seeding operations into three classes, namely: orographic, semiorographic and nonorographic, and into two groups—the West Coast and the inland nonorographic, etc. The results of the evaluations are summarized. Various studies on statistical methods to evaluate cloud seeding experiments included an examination of the characteristics of regression methods of evaluating cloud seeding operations when a target control system is used, the use of the technique of sequential analyses in hail suppression studies, etc. (*Same item as* 10.8–169, Aug. 1959, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding evaluation 2. Cloud seeding studies.**—*I.L.D.*

**11M–767** 551.509.617(795)

Berry, F. A. and Berndt, Gerald D., **On the Oregon State College analysis of cloud seeding in the Tri-County area of Oregon.** *American Meteorological Society, Bulletin,* 38(8):497, Oct. **1957.** table, ref. **DWB**—Comment on article by Decker, Lincoln and Day (*see* 11M–781) regarding the evaluation of 1950–54 cloud seeding operations in the Tri-County area of Oregon, questioning the use of an 11-variable regression to estimate natural rainfall. A table shows that by using this technique, the chances of rejecting the null hypothesis, even if an actual 20% increase occurred in each of the 4 years, is small (about one-fourth). (*Same item as* 9.5–125, May 1958, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding evaluation 2. Cloud seeding in Oregon 3. North Central Oregon.**—*M.R.*

**11M–768** 551.509.617:551.577.11

Bigg, E. K., **The fragmentation of freezing water drops.** *Puy de Dôme. Observatoire, Bulletin, n.s.*, No. 3:65–69, July/Sept. **1957.** 2 figs., 4 refs. English and French summaries p. 65. **DWB**—Experiments are described which are interpreted to mean that many air-borne water drops break into a number of fragments on freezing. About 10–20% break into less than 30 fragments and 0.1% into more. The great majority breaks into a number less than 7, while 6 and 12 are favored numbers of fragments. (*Same item as* 9.9 143, Sept. 1958, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding experiments 2. Fragmentation of water drops.**—*A.V.*

**11M–769** 551.509.617:551.508.99

Bilancini, Raoul, **Semina automatica delle nubi.** [Automatic cloud seeding.] *Rivista di Meteorologia Aeronautica*, Rome, 17(2):67, April **1957. DLC**—Report on Australian experiment with a AgI generator on a DC-3 (RAAF), which is also equipped with a liquid water content meter. (*Same item as* 9.4 110, April 1958, *Met. Abs.*) *Subject Headings:* **1. Air-borne AgI smoke generators 2. Liquid water content meters 3. Cloud seeding with silver iodide 4. Australia.**—*M.R.*

**11M–770** 551.574.1 551.509.6

Birstein, S. J. (*Geophys. Res. Dir., Cambridge, Mass.*), **Studies on the effects of certain chemicals on the inhibition of nucleation.** (In: Conference on the Physics of Cloud and Precipitation Particles, Sept. 1955, **Proceedings.** Pub. N. Y., Pergamon Press, **1957.** p. 376–385. 5 figs., table, 7 refs.) **DLC** (QC921.5.U5), **DWB**—Studies have been made in the laboratory and in the field on the use of certain chemicals to inhibit nucleation. It has been found that chemicals of the type that form co-ordination complexes with heavy metals are the most effective in inhibiting ice crystal formation. Methyl amine and ethyl amine, the compounds investigated most thoroughly, both inhibit silver iodide nucleation below −40°C, the temperature of "spontaneous" nucleation. These two agents appear equally effective on natural type ice nuclei. The results of the "poisoning" studies are analyzed to gain an insight into the mechanism of the reaction, and it is concluded that specific surface compounds are formed on the nucleating agents and, as the nucleating surface is altered, ice-forming ability is diminished. (*Same item as* 9.6–197, June 1958, *Met. Abs.*) *Subject Headings:* **1. Nuclei effectiveness.**—*Author's abstract.*

**11M–771** 551.509.616:546.37:546.15

Boucher, Roland J., **Operation Overseed.** (In: U. S. Advisory Committee on Weather Control, **Final Report, 1957,** pub. **1957.** 2:127–136. 7 figs., table, 7 refs.) **DWB, DLC**—The purpose of "Operation Overseed" carried out in the Mt. Washington, (New Hampshire) area was to determine the effects produced in atmospheric clouds by AgI generators operated at minimum distances from the target clouds, and to obtain data on the dispersal and concentration in the free air, both clear and cloudy, of AgI released at some distance from the sampling point. The equipment, consisting of 28 AgI generators of the propane-acetone type and a cold box, and the operational technique are described with the aid of photographs and a map showing the experimental area and the location of the generators. The results of the 76 full scale seeding operations carried out between Sept. 16, 1955 and June 15, 1956 were judged according to the following criteria: nuclei counts were made at Mount Washington Observatory, the cloud liquid water and drop size measurements at Mount Washington Observatory and visual observations made in the valley. The concentration of ice nuclei can be increased significantly at a distance up to 12 mi by AgI generators emitting about $10^{13}$ particles at −20°C. The nuclei are most effective in producing nucleation of supercooled clouds in the range of −4°C to −15°C. Concentration of artificial nuclei suggests that "overseeding" by "flooding" of supercooled clouds with nuclei is not feasible with generators having an output limited to $10^{13}$ particles per second at −20°C. Extreme stability of the atmosphere is a strong deterrent to the vertical transport of artificial nuclei. AgI nuclei produced by the propane-acetone method appear to have a slow rate of decay. A summary of the data and photographs showing examples of glaciation of supercooled clouds and diagrams of nuclei counts and Operation maps are presented. (*Same item as* 10.8–170, Aug. 1959, *Met. Abs.*) *Subject Headings:* **1. Operation Overseed 2. Cloud seeding with silver iodide 3. Silver iodide smoke generators 4. Mount Washington, N. H.**—*I.L.D.*

**11M–772** 551.509.617:551.574.1

Bowen, E. G., **Rainfall—natural and artificial.** *Australian Institute of Agricultural Science, Sydney, Journal*, 23(3):257–259. Sept. **1957. DA** (23 Au74)—From the two physical processes of rain formation involving warm and supercooled clouds respectively, two possibilities of artificially induced rainfall are derived, namely spraying water droplets from aircraft, and introducing dry ice, following VERAART and LANGMUIR. The advantage of silver iodide over wide areas is proven by VONNEGUT'S theory. The proper conditions for seeding are shown by the results of experiments in

Australia. The different results of application to arid lands are discussed. *Subject Headings:* **1. Cloud seeding techniques 2. Cloud physics.**—*O.T.*

**11M–773** 551.509.616:551.574.1(263,282.272.7)

Braham, Roscoe R., Jr.; Battan, Louis J. and Byers, Horace R. (*all, Chicago Univ.*), **Artificial nucleation of cumulus clouds.** *Meteorological Monographs,* (American Meteorological Society), Boston, 2(11):47–85, July **1957.** 23 figs., 17 tables, 68 refs., 2 eqs. **DWB, DLC**—A thorough and well-illustrated (with photos and graphs, charts, etc.) monographic article summarizing the work done during 1951–54 by the University of Chicago Cloud Physics Project in the laboratory and the Caribbean, and the Central Mississippi Basin. The history of the Project, instrumentation, design of program (physical and experimental), location of flight sectors, seeding elements and their treatment, analysis of data (shown by scatter diagrams and histograms as well as contingency tables) for both test areas and for treated and untreated clouds, laboratory work on particle size and origin, coalescence, capture, etc. and, finally, conclusions. Among these are the following: 1) Importance of ice-crystal or water condensation and coalescence processes differs in the 2 areas; 2) Over the Caribbean the all-water process is the dominant or exclusive one; 3) Over the continent both processes pertain; 4) Large valve water spray treatment was often successful. (*Same item as* 10.8–18, Aug. 1959, *Met. Abs.*) *Subject Headings:* **1. Warm cloud seeding 2. Cloud seeding with water 3. Cloud seeding evaluation 4. Caribbean 5. Central Mississippi Valley.**—*M.R.*

**11M–774** 551.509.617

Braham, Roscoe R., Jr. and Sievers, John R. (*Cloud Phys. Proj., Dept. of Met., Univ. of Chicago*), **Overseeeding of cumulus clouds.** (In: Conference on the Physics of Cloud and Precipitation Particles, Sept. 1955, **Proceedings,** Pub. N. Y. Pergamon Press, **1957.** p. 250–266. 2 figs., 10 tables, 13 refs., eqs.) **DLC** (QC921.5.U5), **DWB**—Data obtained from numerous aircraft flights through cumulus clouds in central U. S. are presented, together with theoretical considerations of dry-ice seeding. It is shown that an expected concentration of sublimation nuclei of $10^8/m^3$ could convert an average cumulus cloud into ice crystals only within 100 sec and the resulting ice crystals would not grow to a size sufficiently large enough to be detected by the methods of measurement indicated. Flight observations indicate that this "drying-up" of a cumulus cloud is not generally observed in clouds treated with dry ice, and that the formation of clear ice on aircraft surfaces in the majority of treated clouds suggests that the resulting concentration of ice crystals from dry-ice seeding is much less than a theoretical yield would indicate. (*Same item as* 9.6–134, June 1958, Met. Abs.) *Subject Headings:* **1. Overseeding 2. Cloud seeding with dry ice.**—*Authors' abstract.*

**11M–775** 551.509.617

†Chicago Univ. Dept. of Meteorology, **Cloud physics and rainmaking: research programs at the University of Chicago.** Chicago. Univ. Dept. of Meteorology, Feb. 4, **1957.** 40 p. 12 figs., 44 refs. **DWB** (M09.67 C532c)—A pamphlet telling in layman's language about the practical and the scientific aspects of artificial rain production—the limitations and partial success to date, the rain formation processes in ice and water clouds, cloud modification under ideal conditions, physical problems and, finally, the research program on cloud physics (begun in 1945) at Univ. of Chicago where the Thunderstorm Project and more recently (since 1952) laboratory research in flight tests of cloud and precip. parameters, and of seeding agents, have been conducted. The 24 members of the staff are profiled, and a long list of papers published by staff members in this field is appended. (*Same item as* 9.9–144, Sept. 1958, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding 2. Cloud physics 3. Weather modification bibliographies. I. Byers, Horace R.**—*M.R.*

**11M–776** 551.509.617:551.576.11

Chuvaev, A. P., **Opyt regulirovaniia razvitiia oblakov moshchnoĭ konvektsii v severo-zapadnykh raĭonakh Evropeĭskoĭ territorii Soiuza SSR.** [Experiment in regulating the development of strong convection clouds in the northwestern regions of European U.S.S.R.] *Leningrad. Glavnaia Geofizicheskaia Observatoriia, Trudy,* No. 67(129):59–103, **1957.** 30 figs., 4 tables, 6 refs. **DWB**—During the summer of 1951 and 1952 a series of cloud seeding experiments with solid $CO_2$ were carried out in order to verify, in different kinds of weather, a previous cloud seeding attempt which resulted in both rainfall and dissipation of the cloud. The characteristics of the clouds investigated (including their thickness, the height of the supercooled layer, the ratio of the supercooled to the warm layer and the temperature range within the clouds) are described and the individual experiments are analyzed in detail. For each experiment the synoptic situation is described and the water content, cloud characteristic, amount of seeding material, the spectrum of cloud droplet sizes and cloud development are presented. The experiments confirm the validity of the previous investigations (*Trudy GGO* [Special Issue] No. 020, **1953**) and they indicate that when intense convection clouds are seeded successfully not only is their growth interrupted but they are dispersed either partly or completely. The introduction of a reagent into the most active zone of the cumulus

clouds, which are not undergoing rapid growth, causes them to dissipate by means of the following amounts of dry ice: 0.5–1.0 kg per 1 km, if the cloud has a supercooled layer 1000–1500 m in thickness, and 1–2 kg per km with a supercooled layer 2000–3000 m in thickness. In dissipating intensely convective clouds, the most efficient method of seeding dry ice is by scattering; but evaporation may have only auxiliary importance by expanding the zone of contamination with ice primordia. The establishment of "optimum standard of reagent requires a consideration of wind distribution with altitudes." (*Same item as* 10.8–172, Aug. 1959, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding experiments 2. Convective clouds.**—*I.L.D.*

**11M–777** 551.509.617:551.576.11(47)

Chuvaev, A. P., **Ob osobennostiakh metodiki vozdeĭstvii "sukhim l'dom" na konvektivnye oblaka s tsel'iu vyzyvaniia iz nikh osadkov.** [Characteristics of the method of influencing convective clouds by dry ice in order to produce precipitation.] *Leningrad. Glavnaia Geofizicheskaia Observatoriia, Trudy* 72:110–117, **1957.** 5 figs., 15 refs. **DLC**—On the basis of an experiment carried out on June 1, 1956 in the Kiev Region, the author describes an effective method of seeding small particles of solid $CO_2$ at the rate of 2.0–2.5 kg per flight-km in the crest of convective clouds and obtaining substantial precipitation, even when the lower cloud limit is relatively high (2000 m) the vertical development is not great (2000 m), and the upper cloud limit reaches only the lower boundary of the effective supercooling zone. The paper concludes with the assertion that although cumulus clouds often have no icing in their tops and do not produce natural precipitation, they can be easily triggered by appropriate methods of seeding. (*Same item as* 10.3–178, March 1959, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with dry ice 2. Kiev Region, U.S.S.R.**—*A.M.P.*

**11M–778** 551.509.616:551.576.11(47)

Chuvaev, A. P.; Tarasov, A. V.; Titov, N. A. and Nikandrova, G. T., **Opyt regulirovaniia razvitiia oblakov moshchnoĭ konvektsii nad znachitel'noĭ ploshchad'iu.** [Experiment in regulating the development of convective clouds over a large area.] *Leningrad. Glavnaia Geofizicheskaia Observatoriia, Trudy,* 72:127–133, **1957.** 7 figs. **DLC**—A report on a successful field experiment to prevent the development of thunderstorm cells by seeding a large convective cloud having supercooled tops with dry ice from a high-speed airplane on June 20, 1956 in the region of Minsk. The seeding of 65 kg of finely crushed dry ice was carried out in three 40 km long flights across the 40×15 km cloud field, at 4500 m height in 20 min. Forty-seven minutes after the seeding began, the cumulus cloud with a 2500×3000 m vertical development had almost disappeared. A series of photos shows diverse stages of the cloud's disintegration. (*Same item as* 10.3 177, March 1959, *Met. Abs.*) *Subject Headings:* **1. Convective cloud seeding 2. Artificial cloud dispersal 3. Minsk, U.S.S.R.** —*A.M.P.*

**11M–779** 551.509.616/7:551.515.4:551.578.7(47)

†Chuvaev, A. P., **O sovremennykh vozmozhnostiakh predotvrashcheniia groz i grada.** [Present possibilities of thunderstorm and hail suppression.] *Leningrad. Glavnaia Geofizicheskaia Observatoriia, Trudy,* No. 74:71–102, **1957.** 23 figs., 39 refs. **DWB** (M(055) U581tg)—A number of experiments carried out during July 1954 and June 1956 in the U.S.S.R. in order to suppress the development of large cumulo-nimbus clouds immediately in the vicinity of a front or close to it, and to prevent the formation of thunderstorms, are described and analyzed. The experiments were made in Krasnoarmeĭskoe District (Stalino-Kharkov route), the Oposhnya District, Nezhin-Kozelets-Konotop District, and the Bol'shoi-Vradnevki District. Synoptic maps showing the state of the weather during the seeding with dry ice from airplanes, and photographs of clouds before and after seeding, are presented. Seeding of large anvil-shaped cumulus clouds are followed after a few minutes by freezing of the tops of the seeded clouds and by rapid subsidence. From the bottom of the cloud, precipitation began to fall over a considerable area. At the same time the unseeded clouds were still increasing in size. The potential gradient of the electric field varied in various experiments from 2 to 50 v/cm. A review of the literature on cloud seeding designed to suppress hail and thunderstorms is presented. (*Same item as* 10.4–143, April 1959, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding 2. Hail prevention 3. Thunderstorm suppression 4. U.S.S.R.**—*I.L.D.*

**11M–780** 551.509.617

Crow, Loren W., **Development of desirable operational standards.** (In: U. S. Advisory Committee on Weather Control, **Final Report, 1957,** pub. **1957.** 2:300–306. 4 figs., 8 refs.) **DWB, DLC**—The author reviews "the considerations involved in the development of desirable standards of personnel, equipment, methods, and materials to be used in weather modification operations." The discussion covers the optimum sizes of particles for serving as efficient nucleating agents, optimum concentration of particles for effective nucleation within a critical temperature, atmospheric turbulence and dispersal of particles; the rationale of commercial cloud seeding projects from the standpoint of feasibility, including frequency of storms, terrain, value of increased water which may be

contemplated, equipment, communication facilities, evaluation of results etc.; the responsibilities of the contractor or cloud seeder and the responsibilities of the client company. *Subject Headings:* **1. Weather modification operations 2. Cloud seeding evaluation.**—*I.L.D.*

**11M–781** 551.509.617(795)

Decker, Fred W.; Lincoln, Russell L. and Day, John A. (*all, Dept. of Physics, Oregon St. College, Corvallis*), **Analysis of cloud seeding efforts in the Tri-County Area, Oregon, 1950–54.** *American Meteorological Society, Bulletin*, 38(3):134–137, March **1957.** 2 figs., 2 tables, 3 refs., 2 eqs. **DWB, DLC**—A multiple regression equation (11 variables) was used to test results of cloud seeding with silver iodide in 1950–54 in 3 counties (Sherman, Gilliam and Morrow) of N. Central Oregon. Precipitation was tested for 7 stations in target area and 4 in Western Oregon (upwind) and records going back to 1930 incorporated in tests. Results show a 6% increase but a 15% increase would be required to be of any significance. A +18–19% increase was obtained on 2 of the 4 years and a −14% and −2% decrease on other 2 (alternate) years. (*Same item as* 9.2–177, Feb. 1958, *Met. abs.*) *Subject Headings:* **1. Cloud seeding evaluation 2. Silver iodide effectiveness 3. Cloud seeding in Oregon 4. North Central Oregon.**—*M.R.*

**11M–782** 551.509.61

†Decker, Fred W., **Scientific communications should be improved.** *Science*, Wash., D. C., 125(3238):101–105, Jan. 18, **1957.** 33 refs. **DLC**—Remarks on ethics in scientific reporting, writing, etc., with special reference to claims of "rain-makers," i.e. those working in the field of cloud seeding. The responsibilities of scientific societies and of the individual scientist to avoid confusing the public by exaggerated claims (for the sake of promotion or profit) are emphasized. *Subject Headings:* **1. Scientific ethics 2. Cloud seeding effectiveness.**—*M.R.*

**11M–783** 551.509.616:551.574.2(675)

Dessens, Henri and Dessens, Jean (*Puy de Dôme Obs.*), **Etude préliminaire des cumulus et des pluies obtenus par convection provoquée.** [Preliminary study of cumulus clouds and precipitation obtained by artificially induced convection.] *Puy de Dôme. Observatoire, Bulletin*, Ser. 2, No. 2:47–60, April/June **1957.** 3 figs., 16 refs. English summary p. 47. **DWB**—The artificial formation of cumulus clouds by means of large grass fires was further pursued at Lukolela (Belg. Congo). Meteorological conditions which favor the formation of clouds by forced convection and the formation of precipitation from such clouds are described and the energies involved are estimated. The cumuli produced in the experiments described are found to be liable to yield precipitation because of the strong updrafts and horizontal eddies in them. Photographs of artificially produced cumuli are presented. (*Same item as* 10.4–144, April 1959, *Met. Abs.*) *Subject Headings:* **1. Artificial cumulus clouds 2. Artificial convective cloud generation 3. Brush fire cloud formation 4. Lukolela, Belgian Congo.**—*G.T.*

**11M–784** 551.574.1:08

Dessens, Henri, **Compte Rendu du Symposium sur la Physique et la Dynamique des Nuages au Congrès de l'U.G.G.I., Toronto, 21 Sept. 1957.** [Proceedings of the Symposium on Physics and Dynamics of Clouds at the I.U.G.G. Conference, Toronto, Sept. 21, 1957]. *Puy de Dôme, Observatoire, Bulletin*, Ser. 2, No. 3:94 96, July/Sept. **1957. DWB**—Over a hundred scientists participated at this conference on cloud physics. The papers delivered are summarized in this account. Atmospheric condensation nuclei, the mechanism of nucleation, natural and artificial cloud formation; thunder cloud electrification, radar cloud photography, cloud physics and modification studies in the U.S.S.R. and cloud seeding evaluation were the principal subjects discussed. (*Same item as* 10.9–67, Sept. 1959, *Met. Abs.*) *Subject Heading:* **1. Cloud physics symposia.**—*G.T.*

**11M–785** 551.509.616(73)

Droessler, Earl G., **Federal government activities in weather modification and related cloud physics.** (In: U. S. Advisory Committee on Weather Control, **Final Report,** pub. **1957.** 2:253–256.) **DWB, DLC**—The author describes the role of the individual departments of the U. S. Government in studies on weather modification and cloud physics since the joint Cirrus Project. The Dept. of Defense organized an Advisory Group on Artificial Cloud Nucleation which surveyed the literature on cloud physics and weather modification and established the following projects: extratropical cyclones, migratory cloud systems, convective clouds, cold stratus and fog, ice fogs and warm stratus. The Dept. of the Army carried out (1) studies on the comparative efficiency of dry ice and AgI seeding, (2) seeding experiments in West Germany, Greenland and Ellesmere Island and developed equipment for nuclei generation. Except for the attempt to seed freezing rain from the ground, the Navy Dept. devoted its attention to problems of cloud physics, contrails, availability of water for precipitation over the U. S., etc. The Dept. of the Air Force chiefly under contract with the U. S. Air Force Geophysics Research Directorate conducted research on the structure of cumulus clouds,

various field studies on smog, fog and related atmospheric contamination and visibility problems, "poisoning" of natural nuclei, etc. The U. S. Weather Bureau engaged in field tests in cooperation with the Dept. of Defense, carried out research on the mechanics of cloud formation and precipitation growth, cloud seeding operations in Southwestern Washington, etc. The National Science Foundation has supported various projects on cloud physics and cloud seeding at universities, which are listed. Also the U. S. Forest Service has engaged in several weather modification projects. (*Same item as* 10.5–192, May 1959, *Met. Abs.*) *Subject Headings:* **1. Weather control in U. S. 2. Cloud physics 3. Cloud seeding 4. United States.**—*I.L.D.*

**11M–786** 551.509.617:551.577.2(549)

Fournier d'Albe, E. M., **Cloud-seeding trials using common salt.** (In: Conference on the Physics of Cloud and Precipitation Particles, Sept. 1955, **Proceedings.** pub. N. Y., Pergamon Press, **1957.** p. 207–212. 2 figs., ref.) **DLC** (QC921.5.U5), **DWB**—Results of NaCl seeding in 1954 by the Pakistan Meteorological Service are analyzed, discussed and illustrated. Cloud bases were usually about 20°C so it was assumed clouds were of the warm type. Seeding from ground generators at Lahore was carried out from July 16–Sept. 15, 1954 on 39 days out of 61 (some seeding was done at Jauharabad in the Thal District, 210 km WNW of Lahore). Seeding was attempted only when winds were easterly and low clouds visible from the station. Results of a comparison of seeding areas with control area (upwind) show an increase of precipitation in 1954 compared with control area precipitation for 1901–1942. Results and significance thereof are discussed at length. (*Same item as* 10.11 129, Nov. 1959, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with salt 2. Cloud seeding evaluation 3. Lahore, Pakistan.**—*M.R.*

**11M–787** 551.509.617:551.578.7(73)

Frank, Sidney R., **Survey and history of hail-suppression operations in the United States.** (In: U. S. Advisory Committee on Weather Control, **Final Report, 1957,** pub. **1957.** 2:264–272. 2 figs., 4 tables.) **DWB, DLC**—The basic concept in hail suppression is the assumption that by the introduction of sufficient nuclei into a potentially hail producing system "the cloud droplets would have limited growth and precipitate out in the form of many showers of small drop and/or hail size rather than a few showers of large drop and/or hail size." The author discusses the growth of hail suppression projects during the period 1949–1956, the evaluation techniques such as the financial approach used by commercial operators, the use of regression equations and hail insurance statistics and the comparative efficiency and value of the procedures for hail suppression employed, namely: ground based generators only, aircraft generators only, and ground and aircraft generators. A chronology of hail suppression in the United States during the period 1949–1957 and an outline of hail suppression activities outside the U. S. (France, Switzerland, North and South Africa, etc.) are given. The appendix contains a paper by R. Sänger on the **Swiss Federal Commission for the Study of Hail Formation and Prevention** which deals primarily with the third large scale experiment to prevent hail in Tessin, Switzerland, during 1957 and 1958. The contents of this paper are as follows: Mathematical-statistical interpretation of results including a description of the experimental set-up; duration of the experiment, experimental unit, and statistical evaluation; the actual measures taken by the organization committee and conduct of the third large scale experiment and the utilization of crop-hail insurance statistics as a measure of hail suppression efficacy (based upon excerpts from a paper by R. J. Roth). A map showing the location of the silver iodide generator stations in Switzerland, and a table with their heights above sea level are presented. (*Same item as* 11.1–182, Jan. 1960, *Met. Abs.*) *Subject Headings:* **1. Hail prevention 2. United States.**—*I.L.D.*

**11M–788** 551.574.2:551.509.617:546.57:546.15

Fuquay, Donald M. (*Res. Meteorologist, Munitalp Found.*) and Wells, H. J. (*President's Advisory Comm. on Weather Control*), **The project Skyfire cloud seeding generator.** (In: U. S. Advisory Committee on Weather Control, **Final Report, 1957.** 2:273–282. 10 figs., 2 tables.) **DWB, DLC**—Cloud seeding generators used in Project Skyfire, which aims at preventing or eradicating lightning fires by suppressing lightning, require the production of enormous quantities of silver iodide nuclei and must be safe to operate in highly inflammable forests. The authors describe in detail with the aid of photographs, diagrams and graphs, the construction, operation, output, etc. of a specially designed silver iodide generator developed by the Skyfire Project. Silver iodide is dissolved in an acetone solution and sodium iodide is drawn from a reservoir through a modified hypodermic needle and nebulized by a cloud of propane gas. This moisture is directed into a flame chamber and ignited. "The volatilized AgI condenses into crystals as the smoke passes around a quench plate mounted above the flame chamber." The quenching action produces a larger output of crystals than an open chimney by limiting crystal growth. The characteristics, operation and nuclei production of other types of smoke generators, such as the string-burning type and acetone-burning generators, and the results of calibration of nuclei output are discussed. (*Same item as* 11.2–239, Feb. 1960, *Met. Abs.*) *Subject Headings:* **1. Silver iodide smoke generators 2. Project Skyfire.**—*I.L.D.*

**11M–789** 551.509.617

Guilmet, B., **La pluie provoquée; le problème de sa rentabilité.** [Rain making; is it economical?] *Cahier des Ingénieurs Agronomes*, Paris, No. 120:13–16, Nov. **1957. DA**—The theory of rain formation, rain-producing agents, seeding techniques, evaluation of the results, and amount of the affected crops are reviewed. The author concludes that rainmaking cannot influence in any way the general development of a weather situation. Its effects are purely local and of very brief duration. (*Same item as* 9.6–133, June 1958, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding evaluation.**—*A.V.*

**11M–790** 551.509.616

Hall, W. Ferguson (*U. S. W. B.*), **The Weather Bureau ACN project.** *Meteorological Monographs*, Boston, 2(11):24–46, July **1957.** 13 figs., 4 tables, 4 refs. **DWB, DLC**—The Weather Bureau has completed a field program in western Washington to investigate the applicability of cloud seeding techniques in migratory cloud systems associated with middle latitude cyclonic activity. The project was designed to give statistically valid estimates of the effects of seeding with dry ice from aircraft, as well as affording surveys of cloud structure with particular reference to natural precipitation mechanisms and seeding potentialities. A number of statistical evaluations have been carried out and, considered as a whole, do not show significant results from the seeding. However, because of the margin of uncertainty present, none of the evaluations excluded the possibility of limited effects. The cloud surveys suggested that favorable seeding opportunities were somewhat infrequent due to the abundance of natural ice crystals in the deeper cloud layers. (*Same item as* 10.10–184, Oct. 1959, *Met. Abs.*) *Subject Headings:* **1. U. S. W. B. ACN project 2. Cloud seeding from airplane 3. Cloud seeding effectiveness 4. Western Washington.**—*Author's abstract.*

**11M–791** 551.509.617

Houghton, Henry G. (*Chairman, Dept. of Met., M. I. T.*), **Other aspects of weather modification: present position and future possibilities of weather control.** (In: *U. S. Advisory Committee on Weather Control*, **Final Report, 1957,** pub. **1957.** 2:286–288.) **DWB, DLC**—After a few brief comments on such forms of weather control as heating of orchards to protect against frost damage and fog dispersal over airports, the author discusses the problem of whether rainfall can be increased significantly by artificial cloud seeding. A theoretical explanation is offered for the apparent effectiveness of cloud seeding of shower and orographically induced clouds. It is suggested that such clouds which are of short duration lose their water by evaporation if precipitation does not occur, but seeding hastens precipitation and hence increases total precipitation. Total precipitation from a cyclonic storm is not affected much by cloud seeding. The possibilities of weather control in terms of influencing the distribution of atmospheric heating are considered. Those include altering reflectivity of the earth's surface, reducing evaporation of water, etc. (*Same item as* 10.8–173, Aug. 1959, *Met. Abs.*) *Subject Headings:* **1. Weather control 2. Cloud seeding effectiveness.**—*I.L.D.*

**11M–792** 551.509.617

Houghton, Henry G. (*M. I. T.*), **Present position and future possibilities of weather control.** *American Meteorological Society, Bulletin*, 38(10):567–570, Dec. 1957. **DWB, DLC.** Also in: *National Conference on Applied Meteorology, Hartford, Conn., Oct. 1957, Proceedings*, issued **1957.** Section C:57–61. **DWB** (M A512pro)—The limitations of rainmaking and possible methods of large-scale weather modification are discussed. A more extensive basic research program is urged as "the only realistic path toward weather control." (*Same item as* 10.1–181, Jan. 1959, *Met. Abs.*) *Subject Headings:* **1. Weather control 2. Artificial precipitation.**—*G.T.*

**11M–793** 550.3:061.3 551.509.61

Hyde, Margaret O., **Exploring earth and space: the story of the I. G. Y.** Illus. by Clifford N. Geary. N. Y., Whittlesey House, **1957.** 160 p. **DLC** (QC801.3.H9), A readable and accurate account of the IGY and its various phases including chapters on earthquakes, volcanoes, the Antarctic, oceanographic research, weather control; atomic, cosmic and solar energy or applications; rockets, satellites, etc. On p. 64–65 the still controversial problem of cloud seeding is described and AWCW's report is referred to as stating that cloud seeding is still in its infancy but holds great promise. (For fuller abstract *see* 9.4–24, April 1958, *Met. Abs.*) *Subject Headings:* **1. History of IGY 2. Popular science books.**

**11M–794** 551.509.616:551.576.11:551.594.12

Imianitov, I. M.; Kulik, M. M. and Chuvaev, A. P., **Predvaritel'nye dannye ob opytakh po regulirovaniiu razvitiia i izmeneniia elektricheskogo sostoianiia oblakov moshchnoĭ konvektsii v iuzhnykh raĭonakh Evropeĭskoĭ territorii Soiuza SSR i v Zakavkaz'e.** [Preliminary data on experiments in regulating the development and changes of electric conditions in strong convection clouds in

the southern regions of European U.S.S.R. and the Transcaucasus.] *Leningrad. Glavnaia Geofizicheskaia Observatoriia, Trudy*, No. 67(129):33–58, **1957.** 20 figs., 5 refs. **DWB**—In the summer, a series of experimental flights along the air routes of Rostov-Krasnodar, Rostov-Mineral'nye Vody, Kiev-Zolotonosha and Sukhumi-Tiflis was made in order to investigate the effect of solid $CO_2$ particles upon powerful convection clouds, cloud fields or individual clouds that had not attained the freezing layer and did not produce a radar echo. The temperature of the surroundings when the reagent was introduced was −4°C. A detailed description of the individual flights, including synoptic maps of the particular weather situation, graphs showing electron charge within the clouds during the flight, radar screen images and cloud photographs. In clouds of intensive convective activity whose tops have not yet reached the freezing state the electric field is relatively small. The introduction of solid $CO_2$ into the supercooled tops of convective clouds produces rainfall and dissipates the clouds. The electric field increases by 6–7 times in 5 min. This increase is associated with the appearance of ice particles and large particles producing radar reflections. The radar echoes appeared first only after the cloud summits had reached the crystallization level and they always appeared after the seeding with the solid $CO_2$. In purely aqueous clouds which are well developed vertically the electric field on the average does not exceed 20 volts/cm; in clouds of mixed structure it may exceed 100 volts/cm. A table giving data on the changes in electric field produced by the seeding of intense convection clouds is included and the possibility of thunderstorm and hail prevention is discussed. (*Same item as* 10.9–162, Sept. 1959, *Met. Abs.*) *Subject Headings:* **1. Electrification of clouds 2. Convective cloud electrification 3. Cloud seeding with dry ice 4. Cloud seeding in U.S.S.R. 5. European U.S.S.R.**—*I.L.D.*

**11M–795** 551.509.617(569.4)

Jaffe, S., **Annual report on a cloud seeding project in Israel, 1956/1957, prepared for the Rainfall Committee of the Research Council of Israel.** Hakirya, Tel-Aviv, Aug. **1957.** 8 p. chart, table.—A summary of the activities of the Artificial Rain Project in Israel during the period from Dec. 1956 through Aug. 1957. A target area in northern Israel was seeded with AgI from ground generators during the main winter period which extends from Nov. to the end of April. All the days during this interval were randomly divided into "seeding days" and "nonseeding days." The results of seeding are evaluated by a method involving "the correlation between precipitation amounts in the target and in control area and the fitting of theoretical frequency distribution curves to this date." This distribution, which is of a Pearson Type III, is then transformed by equiprobability relationship to a standardized normal distribution. Also a ratio was computed for some stations in Israel between the accumulated precipitation amounts during the seeded and unseeded days of this season. The area of the highest values of the ratio approaches closely the planned target. This may be explained by the fact that the actual target or the affected area does not coincide always with the planned target and that a precipitation maximum was found nearer to the coast than the estimated cloud-seeding target. A list of the days selected randomly for cloud seeding during the 1956/57 rain season, the hours of operation during the same rain season and a map showing the target area, the generator location and isohyets for the 1956/57 are presented. (*Same item as* 10.8–174, Aug. 1959, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding projects 2. Cloud seeding in Israel 3. Israel.**—*I.L.D.*

**11M–796** 551.551:551.43:551.509.617

Kassander, A. Richard, Jr., **Study of the trajectories and diffusion patterns of ground-generated airborne particulates under orographic wind flow conditions.** *Arizona. Univ. Institute of Atmospheric Physics, Scientific Report*, No. 5, May 15, **1957.** 16 p. 19 figs. (incl. photos). **DWB** (MO8.21 A719s)—In late June and early July, 1956, a series of experiments was performed in the Rincon Valley 20 mi SE of Tucson, Ariz., to determine the wind structure over an orographic barrier and to ascertain whether ground-generated aerosols reach cloud heights in such a situation. Zinc sulfide particles were dispersed in an oil fog from a ground-located fog generator and collections were made using airborne impactors. Particles were found at elevations of at least 14,000 ft at distances out to at least 20 mi. However, "plumes" were found to be considerably broader than had been anticipated and the structure of the wind over a mountain ridge is judged to be substantially more complex than has been assumed in cloud-seeding operations. (*Same item as* 9.7–205, July 1958, *Met. Abs.*) *Subject Headings:* **1. Air flow over mountains 2. Orographic diffusion patterns 3. Cloud seeding techniques. I. Contract NSF G1101 II. Arizona Univ. Inst. of Atmospheric Physics.**——*Author's abstract.*

**11M–797** 551.509.61:551.574.2:546.57:546.15

Kissinger, H. E. and Mitchell, E. Z., **Studies on the crystallography of silver iodide nuclei.** [Report] To the Advisory Committee on Weather Control, April 1–June 30, 1957. *U. S. National Bureau of Standards, NBS Report* 5474, (**1957?**) 6 p. 2 figs. Text is carbon of typescript. **DWB** (MO9.617 U585cr)—A review of studies on the crystallography of Silver Iodide Nuclei. Silver

Iodide is often used in weather modification experiments. Experiments with supercooled vapor in test chambers have demonstrated a loss of nucleating ability, with aging. Under certain conditions the ice crystals resulting from Silver Iodide nuclei are prismatic rather than the more common hexagonal shape. This laboratory has begun an intensive study of the crystal structure of nuclei. Electromicrograph and X-ray diffraction photographs are shown. *Subject Headings:* **1. Silver iodide property 2. Crystallography 3. Crystalline nuclei.**—*E.Z.S.*

**11M-798** 551.574.1:551.509.617

†MacCready, P. B. Jr.; Smith, T. B.; Todd, C. J. and Beesmer, K. M., **Nuclei, cumulus, and seedability studies: Project Seabreeze, Pasadena cooperative program of ice nuclei measuring techniques, Mt. Withington Project, Santa Barbara radar evaluation and other studies.** (In: U. S. Advisory Committee on Weather Control, **Final Report,** pub. **1957.** 2:137–200. 54 figs., 3 tables, 54 refs.) **DWB, DLC**—A comprehensive and detailed report on the physical evaluation of the validity of cloud seeding effects in the formation of rain, snow, hail and lightning in the experiments carried out by Meteorology Research, Inc. under the sponsorship of the Advisory Committee on Weather Control. Pt. I contains a historical account of the various projects from their beginning in the summer of 1955 to their termination in the summer of 1957. A description of the organization, conduct and equipment of a typical field experiment. With the aid of photographs the authors describe the various types of equipment used, namely: time-lapse cameras; projectors, portable cold box, aircraft, radar, silver iodide generators, ion collector, cloud droplet sampler; Pt. II, **Cumulus studies,** is concerned with the execution and evaluation of the experiments in which clouds were seeded with silver iodide ground generators in order to introduce freezing nuclei into convective clouds and obtain precipitation; Pt. III, **Nucleation and natural nuclei studies,** deals with studies on the dimensions, concentration and distribution of natural freezing nuclei with the aid of the Australian expansion box, the application of laboratory observations on natural nuclei to conditions within clouds, the reactivation of nuclei and the role of industrial nuclei as freezing nuclei; Pt. IV, **Report on the Pasadena cooperative program of ice nuclei measuring techniques,** deals with freezing nuclei concentration measurements using the Australian expansion box, MRI dual temperature box, Australian Bigg box, Signal Corps box and deep freeze box. The various types of apparatus are described with the aid of photographs and the discussion covers the following: the results of comparative measurements of natural nuclei concentrations, effect of moisture on nuclei counts, silver iodide and dust measurements with these boxes, effect of fragmentation or generation of ice crystals at the interior walls of the boxes, etc; Pt. V, **Silver iodide study,** includes studies of plumes from silver iodide ground generators and their tracing and decay, the nature of a plume model, and the use of the portable cold box for simulating temperature and moisture conditions inside a "typical cloud" at the precipitation producing stage; Pt. VI is concerned with the procedures and results of the Santa Barbara radar evaluation study, the cloud electrification studies at Boca Raton, Missoula (Montana) and the value of electrification as a research tool; the results of traverse seeding with light aircraft at Missoula; and the results of small scale seeding of low supercooled stratus with silver iodide and dry ice at Missoula. (*Same item as* 10.5–193, May 1959, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding evaluation 2. Cloud seeding effects 3. Cloud seeding projects 4. Freezing nuclei 5. Cloud seeding with silver iodide 6. Santa Barbara, Calif. 7. Pasadena, Calif. 8. Missoula, Mont.**—*I.L.D.*

**11M-799** 551.509.61:551.574.11:546.15

Malkina, A. D., **Dannye issledovaniĭ nekotorykh fiziko-khimicheskikh svoĭstv chastits iodidov, iavliaiushchikhsia ledoobrazuiushchimi iadrami.** [Results of investigations on some physicochemical properties of iodide particles, which act as freezing nuclei.] *Moscow. Tsentral'naia Aerologicheskaia Observatoriia, Trudy,* No. 22:117–124, **1957.** 3 figs., 10 refs. **DWB.** Also her: **Issledovanie fiziko-khimicheskikh svoĭstv chastits iodidov, iavliaiushchikhsia ledoobrazuiushchimi iadrami.** [Study of the physical chemical structure of iodide particles serving as ice-forming nuclei.] *Meteorologiia i Gidrologiia,* Leningrad, No. 1:32–33, **1958. DWB, DLC**—The aerosol forms of AgI, $PbI_2$ and $CdI_2$ were examined by the electron microscope. The AgI particles do not have the clear outlines characteristic of hexagonal crystals and their dimensions lie between $3\times10^{-6}$ and $6\times10^{-5}$ cm. $PbI_2$ forms noncrystalline and crystalline forms of hexagonal shape. $CdI_2$ aerosol particles are spherical —0.5 to 0.03$\mu$ in size. On interactions with water vapor AgI and $PbI_2$ do not alter shape and size. Under the influence of water droplets AgI particles do not change but $PbI_2$ particles dissolve. Aerosol formed on sublimation of AgI ($T_B$ =600°C) consists 90–85% of Ag and 10–15% of $Ag_2O$. Aerosol formed by sublimating $PbI_2$ under the same conditions corresponds to the original substance; aerosol formed by burning briquets containing $CdI_2$ corresponds to pure $CdI_2$. These data are confirmed by electronographic investigations carried out parallel with ultramicrochemical studies of aerosols. The results of such studies are summarized. (*Same item as* 10.6–248, June 1959, *Met. Abs.*) *Subject Headings:* **1. Nuclei effectiveness 2. Iodide nuclei.**—*I.L.D.*

**11M 800** 551.509.61:551.574.2:546.57:546.15

Malkina, A. D., **Resul'taty issledovaniia nekotorykh fiziko-khimicheskikh svoistv dymov iodidov.** [Results of investigations on certain physico-chemical properties of iodide smoke.] *Mezhvedomstvennaia Konferentsiia po Voprosam Issledovaniia Oblakov, Osadkov i Grozovogo Elektrichestva, 5th, Leningrad, 1956, Issledovanie oblakov, osadkov i grozovogo elektrichestva.* Pub. **1957.** p. 127–128. **DLC** (QC921.M4 1956c)—Properties of particles of silver, lead and cadmium iodide smoke obtained by sublimation of the corresponding salts at temperatures of 600–900°C, were investigated by means of electron-microscopic and microchemical methods. This investigation, and a study of the interaction of these particles with water, show that the chemical structure of a part of the aerosol formed in the process of sublimation does not correspond to that of the original iodide. The change of state involves the formation of oxides of metals having no hexagonal structure. In AgI aerosol formation by the method described, AgI losses on account of oxidation amount to 10–15%. In aerosol formation by burning coal impregnated with an AgI solution the losses are higher. The experiments have shown that water vapor does not affect the form and size of iodide aerosol particles. Water droplets, while leaving AgI particles unaffected, will dissolve $PbI_2$ particles considerably. *Subject Headings:* **1. Silver iodide properties 2. Artificial nuclei.**—*Ref. Zhur. Geofiz., 6713, 1958.*

**11M–801** 551.574.1:551.509.617

Manson, James E. (*Atmos. Phys. Lab., Geophys. Res. Dir., Cambridge, Mass.*), **Ice nucleation and the structure of nuclei crystal faces.** (In: Conference on the Physics of Cloud and Precipitation Particles, Sept. 1955, **Proceedings.** N. Y., Pergamon Press, **1957.** p. 360–368. 6 figs., 14 refs.) **DLC** (QC921.5.U5), **DWB**—The nucleating effectiveness of hexagonal and cubic silver iodide injected into supercooled water clouds has been found to be substantially the same. The effectiveness of two modifications of calcium carbonate, vaterite and calcite, has been found to differ widely, vaterite being effective and calcite not effective. A study of the structure of those faces prominently developed on the nuclei particles indicated that the crystallography of nuclei crystal faces is very important in determining effectiveness in seeding supercooled water clouds. (*Same item as* 9.7–217, July 1958, *Met. Abs.*) *Subject Heading:* **1. Nuclei effectiveness.**—*Author's abstract.*

**11M–802** 551.574.2

Mason, B. J. and Hallett, J., **Ice-forming nuclei.** *Nature*, London, 179(4555):357–359, Feb. 16, **1957.** fig., table, 4 refs. **DWB**—Further tests showed that iodine crystals act as ice-forming nuclei below −14°C in the presence of aerosol particles, and cupric sulphide below −6°C. Cuprous iodide and vanadium pentoxide were active at about −15°C. It appears that initiation and growth of ice on a foreign substrate are determined partly by other factors than lattice geometry. (*Same item as* 8.7–260, July 1957, *Met. Abs.*) *Subject Heading:* **1. Freezing nuclei.**—*C.E.P.B.*

**11M–803** 551.509

Mason, B. J. (*Imperial Coll. of Sci. & Tech., Univ. London*), **Meteorology.** (In: Bates, D. R. (*ed.*), **The Earth and its atmosphere.** N. Y., Basic Books, **1957.** p. 174–203. 4 figs.) **DLC**—Forecasting by synoptic methods, methods of synoptic analysis, development of weather systems, conventional and machine prediction techniques, future developments in forecasting; and the basic principles of cloud physics and rain making are treated in a popular style with sufficient schematic and illustrative synoptic material to allow easy visualization of the problem. (*Same item as* 10.4–129, April 1959, *Met. Abs.*) *Subject Headings:* **1. Synoptic meteorology 2. Cloud physics 3. Artificial precipitation.**—*M.R.*

**11M–804** 551.509.617 628.1

Mendes Correa, A. A. (*Univ. do Porto, Portugal*), **A agua, nos seus ciclos, ao servico do homen.** [Water in its cycles at the service of man.] *Sociedade de Geografia, Lisbon, Boletim,* Ser. 75, No. 1/3: 43–52, Jan./March **1957.** ref. English summary p. 52. **DLC**—A paper by Gilbert Ducellier (**Vers . . . l'aménagement des fleuves aériens en Afrique du Nord**) on successful cloud seeding (AgI from aircraft) in Algeria is reviewed and possible applications to Cape Verde Islands are discussed as well as the decisive influence of water upon human population and economy. (*Same item as* 10.5–195, May 1959, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with silver iodide 2. Water resources 3. Algeria.**—*G.T.*

**11M–805** 551.509.615(798)

Mitchell, John Murray, Jr. (*Office of Climatology, U. S. W. B., Wash., D. C.*), **The feasibility of artificial fog dispersal in Alaska.** Wash., D. C., U. S. Weather Bureau, July 2, **1957.** 44 p. 9 figs., 12 tables, 22 refs. Mimeo. **DWB** (MO9.65 U587f)—A climatological analysis is presented of the characteristics of fog and ice fog at three major Air Bases in Alaska. Following a brief survey of fog dispersal methods in general, the climatological data are then employed to select a "best

method" of fog dispersal at each base. Evidence is presented that nearly all winter fogs at Elmendorf Air Force Base are amenable to local dispersal at the runway by ground seeding with dry ice or silver iodide smoke, and that the incidence of closed terminal weather due to fog can potentially be reduced by this means from 3.5% at present to less than 1%. Evidence is also presented that conditions of wind and stability during ice fog at Eielson Air Force Base and Ladd Air Force Base are very often such as to favor local dispersal of such fogs by means of horizontal-axis fans. A fan system is proposed in which 15 fans, each with an effective fanwheel diameter of 15 feet and a dual power setting of 200/400 HP, are positioned along one mile of runway, and directed obliquely across the runway in either of two remotely controlled positions. With such an installation the winter-season incidence of closed terminal weather due to (ice) fog can potentially be reduced from about 10% at present to a fraction of 1%. (*Same item as* 9.7–146, July 1958, *Met. Abs.*) *Subject Headings:* **1. Artificial fog dissipation 2. Ice fog 3. Alaska.**—*Author's abstract.*

**11M–806** 551.509.615(794)

Neiburger, M., **Weather modification and smog.** *Science*, Wash., D. C., 126(3275):637–645, Oct. 4, **1957.** 4 figs., 2 tables, 6 refs. **DLC**—In a quite technical informative article, the author discusses critically a number of suggested methods for dispersing or preventing smog in the Los Angeles basin. Among these are 1) penetrating or dissipating the inversion; 2) blowing the smog away; 3) use of the solar energy to alter the environment favorable for smog; 4) triggering potential instability; 5) reducing insolation. *Subject Headings:* **1. Smog control 2. Weather modification schemes 3. Los Angeles Basin, California.**—*M.R.*

**11M–807** 551.574.11:551.578.41 551.509.617 (52)

Nemoto, S.; Takahashi, Y.; Soma, K. and Kudo, T. (*all, Met. Res. Institute, Tokyo*), **On the observation of the number of ice crystal nuclei in the air near the ground at Tokyo, and the effect of the cloud seeding with silver iodide at the top of Mt. Fuji.** *Meteorological Society of Japan, Tokyo, Journal*, Ser. 2, 35(2):137–140, April **1957.** 15 figs., table, 3 refs. In Japanese; English summary p. 137–138. **DWB, DLC**—In order to detect the increase in the number of ice crystal nuclei in the air near the ground at Tokyo due to cloud seeding and to obtain a basis for determining whether or not cloud seeding might be effective for rainfall, the authors studied a period from Feb. to March 1956. Observations were made for two 5-min periods at each observation time of 11 a.m., 2 p.m. and 4:30 p.m. every day with some flexibility. The "continuously sucking" method was adopted instead of "small sampling." With the exception of seeded days, the number of ice nuclei at Tokyo are as follows: 1. Their number increased with wind velocity (Fig. 7); 2. Their maximum and mean values were 0.8 and 0.25, respectively per litre of air (Fig. 10); 3. Their number did not depend on wind direction and weather conditions (Figs. 8 and 9). The effect of the cloud seeding with silver iodide at the top of Mt. Fuji through 4 seeding experiments made on March 2, 3, 9, and 10 is shown in Fig. 1. No increase could be found because of the deviation of the path of smoke from the Tokyo area 2. Their maximum values amounted to about 3 or 4 times as large as that of unseeded usual days. (*Same item as* 12.1–268, Jan. 1961, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with silver iodide 2. Ice crystal nuclei 3. Tokyo, Japan.**—*K.C.*

**11M–808** 551.509.616/7:546.264

Nikandrov, V. Ia., **Osnovy normirovaniia tverdoĭ $CO_2$ pri vozdeĭstviiakh na pereokhlazhdennye oblaka i tumany.** [Principles of standardization of solid $CO_2$ for seeding supercooled clouds and fogs.] *Mezhvedomstvennaia Konferentsiia po Voprosam Issledovaniia Oblakov, Osadkov i Grozovogo Elektrichestva, 5th, Leningrad, 1956, Issledovanie Oblakov, Osadkov i Grozovogo Elektrichestva.* Publ. **1957.** p. 116–119. eqs. **DLC** (QC921.M4 1956c)—The case of a solid $CO_2$ pellet moving in a cloud with the speed of an airplane, and of one falling through the cloud under the influence of gravity, are investigated. Theoretical expressions are derived for the area in which sublimation nuclei form, the number of ice nuclei, the extent of the front of ice nucleus propagation, the amount of moisture required for the ice nuclei to grow to the size of precipitating particles, and the time of precipitation initiation. *Subject Heading:* **1. Cloud seeding with dry ice.**—*Ref. Zhur. Geofiz., 6883, 1958.*

**11M–809** 551.509.617:551.574.2

Nikandrov, V. Ia. (*MGO, Leningrad*), **The problem of the artificial control of cloud and fog.** Transl. of original Russian (source not given), from **1957** [?] imprint. 13 p. 19 refs., 16 eqs. Mimeo. **DWB** (MO9.67 N692pr)—A summary of laboratory and field experiments in seeding supercooled clouds with dry ice (at the GGO in Leningrad since 1946) and with other substances such as AgI. A table shows relative success of 60 solid carbon dioxide seeding tests classified into 5°C temp. categories from −6° to −20°C (and −3° to −5°, −1° to −2° and 0°C). Slight precip. occurred in 43 cases and precip. reached the ground in 28 cases. Failures were, respectively, 6 and 10, and, indefinite, 11 and 22 cases. Greatest percent success was at −6° to −10°C. Cloud dissipation (for clouds of <800 m thickness) was said to be almost always effective at temp. < −40°C

(supercooled). Practical value for aviation is stressed. The addendum gives more information on the physical processes of cloud nucleation and rain formation. (*Same item as* 10.8–175, Aug. 1959, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with dry ice 2. Cloud seeding in U.S.S.R. 3. Cloud seeding evaluation 4. Artificial cloud dispersal 5. Leningrad, U.S.S.R.**—*M.R.*

**11M 810** 551.509.616:551.576.11:546.264

Nikandrova, G. T. and Chuvaev, A. P., **K issledovaniiu perestroĭki mikrostruktury oblakov pri vozdeĭstvii na nikh tverdoĭ uglekislotoĭ.** [Investigations on the modification of the microstructure of clouds by seeding with solid $CO_2$.] *Leningrad. Glavnaia Geofizicheskaia Observatoriia, Trudy*, No. 67(129):104–113, **1957.** 7 figs., 4 refs. **DWB**—During the winter of 1951 a series of nine cloud seeding experiments was carried on in the Leningrad and Pskov oblasts. Clouds of the St, As, Sc and Cu type were seeded with dry ice which was scattered into their summits in the form of fine grains. The changes in the external structure of the clouds and their microstructure including the distribution of cloud drop size, and dimensions and shape of crystals formed were investigated. When the optimum amount of dry ice is introduced into supercooled stratus clouds crystals are formed; these grow rapidly and precipitate and thereby dissipate the clouds. The dissipation of the clouds begins 5–10 minutes after seeding. The predominating shapes of crystals formed as a result of seeding were hexagonal and triangular platelets. Such crystals were formed in Sc, Cu and As clouds, in the upper boundary of As very large droplets with a maximum distribution at $d = 40\mu$ were present. The optical phenomenon of clouds included the formation of glories with colored rings around the airplane shadow on the surface of the clouds. *Subject Headings:* **1. Cloud seeding with dry ice 2. Artificial cloud dispersal 3. Leningrad, U.S.S.R.**—*I.L.D.*

**11M-811** 551.577.38:551.509.617:551.509.3(72)

*Noble, Gontran and Lebrija Celay, Manuel, **La sequia en México y su prevision.** [Drought in Mexico and its forecast.] *Sociedad Mexicana de Geografía y Estadística, Boletín*, 83(1/3), Jan./June 1957 and 84(1/3), July/Dec. **1957.** 2 vol. (937 p.) numerous figs., graphs, tables. **DWB.** Also: **La sequia en México y su prevision.** [Drought in Mexico and its forecast.] *Ingeniería Hidráulica en México*, Mexico City, 10(4):85–98, Oct./Dec. **1956.** 49 figs., 2 graphs, table. **DWB**—The first 33 pages of this voluminous work deal with quantitative long range forecasting of drought in India and Japan (WALKER and CO-CHIN CHU, respectively). From p. 34–240 there is a comprehensive study of the synoptic weather patterns resulting in drought (as represented by a reversal of the normal seasonal patterns which give frequent or heavy rains at the times when they are economically mandatory). Historic droughts and hurricanes (bringing heavy rains) are discussed and illustrated by numerous charts. A chronological list of weather events causing losses to agriculture in Mexico from 1610–1951 is found on p. 122–173. Studies based on statistical analysis of precipitation records for the purpose of forecasting drought (cycles) are found on p. 174–240. A detailed study of the history of the Mexican meteorological work and charts and discussion of other climatic elements (temperature, frost, etc.) and their effect on agriculture; artificial rainfall experiments, etc. are found on p. 241–344. Irrigation and groundwater comprise the subject matter for the next chapter (p. 345–436), and other agricultural factors the remainder of the two volume work. The second article, from *Ingeniería Hidráulica en México*, is a reproduction of a part of the book which was entitled **Analisis de algunas sequias registradas en el pais a partir del año de 1875.** It contains detailed analysis of mean synoptic patterns and particular situations which result in drought in Mexico. Examples of the most serious droughts since 1870 are studied to show synoptic and isohyetal conditions during a number of specific months as represented by charts. Graphs show time variations in mean annual precip. at several stations in Mexico and elsewhere (1901–50). (*Same item as* 9.8–16, Aug. 1958, *Met. Abs.*) *Subject Headings:* **1. Drought, Mexico 2. Cloud seeding in Mexico 3. Drought forecasting 4. Mexico.**—*M.R.*

**11M-812** 551.509.61:34

Oppenheimer, Jack C., **The legal situation (of weather control).** (In: U. S. Advisory Committee on Weather Control, **Final Report, 1957.** pub. **1957.** 2:211–232. 17 refs.) **DWB, DLC**—This paper constitutes "a statement of the legal situation which together with the scientific and other findings of the Advisory Committee on Weather Control underlie the consideration and formulation of legislative recommendations for future Federal Government research and regulatory activities in the field of weather modification." The author discusses the constitutional bases for federal and state regulating legislation; federal legislation on weather modification operations; state laws regulating weather modification activities; the nature and results of litigation involving suits of damages against cloud seeders; the relationship between legal safeguards and scientific development in the regulation of weather modification by the courts; and a legislative recommendation for conducting weather modification studies without the hazards of litigation. Existing state statutes on weather modification are presented. *Subject Headings:* **1. Weather control legislation 2. Legal aspects of weather control.**—*I.L.D.*

**11M–813** 551.509.617(09)

Orville, Howard T. (*Bendix Aviation Corp., Baltimore, Md.*), **Some aspects of weather modification (cloud seeding).** *Eastern Snow Conferences, 1956 and 1957, Proceedings*, pub. **1957.** 4:113–116. **DWB** (MO6 E14p)—The history of the Advisory Committee on Weather Control is summed up and its activities are outlined. The author refers to positive evidence of an effectiveness of cloud seeding operations but cautions farmers against irresponsible and fraudulent cloud seeding companies or individuals. *Subject Headings:* **1. U. S. Advisory Committee on Weather Control 2. Cloud seeding.** —*G.T.*

**11M–814** 551.509.617:631

Orville, Howard T. (*Friez Instrument Div., Bendix Aviation Corp.*), **What every grower should know about weather modification (cloud seeding).** *Connecticut Pomological Society, 67th Annual Meeting, Dec. 1957.* [*Proceedings*]. p. 339–47. Abstracted from photostat. **DWB** (MO9.67 O79wh)—Weather modification or cloud seeding has become an asset to farming in recent years. This report covers the experimental program in cloud seeding set up in the Great Plains states and Texas and other states. It gives a brief history and outlines the progress, and the benefits that have been derived through its applications as well as the congressional actions. *Subject Heading:* **1. Cloud seeding experiments.**—*N.N.*

**11M–815** 551.509.617:551.578.7:632.134(451.1)

Pellisari, L., **Difesa contro la grandine.** [Protection against hail.] *Rivista di Meteorologia Aeronautica*, Rome, 17(2):67, April/June **1957. DLC**—A new method of anti-hail action, using radioactive oxide to complement the present use of rockets. The new system allows for protection of 250,000 ha of cultivated land in the Piedmont region. The material is disseminated from balloons during storms in clouds appearing to be hail producing. (*Same item as* 9.8 232, Aug. 1958, *Met. Abs.*) *Subject Headings:* **1. Radioactive oxide hail suppression 2. Hail prevention in Italy 3. Piedmont, Italy.**—*M.R.*

**11M–816** 551.509.616:551.576.11:08

*†Petterssen, S. et al., **Cloud and weather modification: a group of field experiments by S. Petterssen; J. Spar; F. Hall; R. R. Braham, Jr.; L. J. Battan; H. R. Byers; H. J. aufm Kampe; J. J. Kelly and H. K. Weickmann.** *Meteorological Monographs* (pub. by American Meteorological Society), Boston, 2(11), July **1957.** 111p. figs., photos, tables, bibliogs. **DWB, DLC.** Review in *Geofisica Pura e Applicata*, 39:238, **1958.**—The monograph consists of 5 articles (with excellent photographs, maps, diagrams, tables, etc.) by the authors named above, outlining programs and procedures by government agencies in several investigations for testing the efficiency of artificial nucleation of extratropical cyclones, migratory cloud systems, convective cumulus clouds, cold and warm strata, ice and fogs (for pertinent items *see* 11M–761, –773, –790, –829). This included the program of the Advisory Group on Weather Modification (1951–54), Project "Scud" (New York Univ.), the U. S. W. B.-A.C.N. (artificial cloud nucleation) project, the Univ. of Chicago Cloud Physics Project, and the Evans Signal Laboratory. (*Same item as* 10.5–5, May 1959, *Met. Abs.*) *Subject Headings:* **1. Cloud modification projects 2. Cloud seeding evaluation.**—*M.R.*

**11M–817** 551.509.61(73)

Petterssen, Sverre (*Chic. Univ.*), **Reports on experiments with artificial cloud nucleation: introductory note.** *Meteorological Monographs*, Boston, 2(11):1–4, July **1957.** 4 refs. **DWB, DLC** —A review of history of weather modification research in the U. S., seeding with dry $CO_2$, warm and cold cloud seeding, Project Cirrus, the Cloud Physics Project, the work of the Advisory Group on Weather Modification (1951–54), and field projects under the Advisory Group: (1) Extratropical cyclones, (2) Migratory cloud systems, (3) Convective clouds, (4) Cold stratus and fog, (5) Ice fogs, (6) Warm stratus. The review serves as an introduction to the meteorological monograph on cloud and weather modification (Vol. 2, No. 11). (*Same item as* 11.2–157, Feb. 1960, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding projects 2. Weather control in U. S.**—*M.R.*

**11M–818** 551.574.1:551.509.616/7(437)

Podzimek, Josef and Koldovský, Milan (*both, Geophys. Inst. Czechoslov. Acad. of Sc., Prague*), **Bemerkungen zu den Arbeiten der ehemaligen Wolkenforschungsstelle in Prag (I. Teil),** [Comments on the work of the former cloud research institute at Prague, Pt. 1] *Studia Geophysica et Geodaetica*, Prague, 1(2):327–341, **1957.** 9 figs., 2 tables, 7 refs. **DWB**—Using recently discovered data of the Wolkenforschungsstelle of the Reichamt für Wetterdienst in Prague, directed by Findeisen during the Second World War, the authors attempt to present a complete picture of the research on cloud physics and weather modification carried out in the institute during the war years and to evaluate the work critically. The laboratory experiments in glass beakers carried out in order to determine the spectra of ice particles and the relationship between the formation of ice crystals and various physical

and chemical conditions are described and the results obtained are summarized. The general procedure involved the use of a glass beaker, having a capacity of 5 liters, which was cooled by a mixture of alcohol and solid dry ice in an Erlenmyer flask. The beaker was made air tight. As soon as the air was introduced into the beaker it was cooled. The formation of fog as influenced by internal and external temperatures during cooling in the case of changes in the apparatus and in the presence of various chemical substances was observed and the formation of ice crystals was evaluated qualitatively. The results are presented in graphs and tables. It is concluded that beaker experiments are suitable for general orientation and simulate only roughly actual atmospheric processes; temperatures of ice crystal formation exceeding −20°C are subject to large errors. A series of experiments in which clouds were seeded from airplanes with polishing sand was carried out. These showed dissolution of clouds and ice crystal formation in some cases. These experiments indicate success in altering cloud development and microphysical structure. *Subject Headings:* **1. Cloud physics research 2. Cloud seeding experiments 3. Cloud seeding with sand 4. Prague, Czechoslovakia.**—*I.L.D.*

**11M–819** 551.509.617:551.574.2

Reynolds, Robin R., **Santa Barbara project.** (In: U. S. Advisory Committee on Weather Control, **Final Report, 1957,** pub. **1957.** 2:249–252. 3 figs.) **DWB, DLC**—The Santa Barbara Project is a research program specifically designed with the necessary scientific control and instrumentation to test the efficiency of the widely used method of AgI cloud seeding to increase precipitation by using ground based silver iodide smoke generators. The cooperative agencies and project directors are listed. The project responsibilities, operational procedures and evaluation program are described. A map showing the subdivision of the target and the location of AgI smoke generators and photographs of the type of generators used and the radar installation are presented. (*Same item as* 10.6–161, June 1959, *Met. Abs.*) *Subject Headings:* **1. Project Santa Barbara 2. Cloud seeding with silver iodide 3. Silver iodide smoke generators 4. Cloud seeding evaluation.**—*I.L.D.*

**11M–820** 551.509.617:551.578.7

Rui, Dino, **La difesa antigrandine** [Hail protection.] *Mantova,* Mantua (n. s.) March **1957.** p. 4–12. 3 figs., 2 tables. **DA** (287 M315)—The efficiency of hail protection in the past, present and future is surveyed. F. RUBY's theory on hail formation is appraised by considering thermodynamic and the electrical processes. Modern observations since 1936 in Europe, including the French, Swiss and Austrian-Yugoslavian organizations are mentioned. The efforts made in Italy, the employed material, the organization of observation stations, evaluation, and expenses of hail control are discussed. Elements in the evaluation of results of the 1956 season and propositions for the future are listed. The construction of hail rockets and their applications are illustrated. *Subject Headings:* **1. Hail prevention 2. Hail rockets.**—*O.T.*

**11M–821** 551.509.6

Schaefer, V. J.; Vonnegut, B.; Barrows, J. S., et al., **The future [of weather control].** (In: U. S. Advisory Committee on Weather Control, **Final Report, 1957.** 2:201–207.) **DWB, DLC**—The authors present an overall survey of the problem of weather control as a continuing research problem involving scientific techniques and knowledge but also financial support, scientific personnel and planning. The discussion includes the following: possible methods of weather control, including cloud, dry ice and water seeding, altering the radiation and the water balance of the earth, etc; inadvertent weather modification such as man made smoke; undesirable effects of weather control; obstacles to the evaluation and development of weather control; future of meteorology to attract its share of scientific talent; need for federal support and for the diversification of sponsorship of research; stabilization and continuity of research; selection of research problems and some of the various problems that need research (cause of tornadoes, electrification in clouds, etc.); the establishment of a favorable environment for research, including interdisciplinary cooperation, the planning and execution of small scale, flexible instruments and interchange of information. An outline of suggestions for further research on weather control is presented: possible studies on freezing nucleation, on condensation nuclei development of hydrometeors, dynamics of clouds and larger scale interrelationships; cloud census; atmospheric electricity and applied cloud seeding developments. (*Same item as* 11.1–177, Jan. 1960, *Met. Abs.*) *Subject Headings:* **1. Weather control. I. MacCready, P. B., Jr.**—*I.L.D.*

**11M–822** 551.509.6

Schaefer, Vincent J., **Introduction and summary.** (In: U. S. Advisory Committee on Weather Control, **Final Report, 1957,** pub. **1957.** 2:99–104.) **DWB, DLC**—In this introductory paper, the author briefly discusses the present state of knowledge on weather modification and then summarizes the results of the various projects on weather modification undertaken under the auspices of the Advisory Committee on Weather Control. These projects are: Project Overseed; Project Sailplane, Montana, 1956; Project Seabreeze, 1956; Pasadena Conference on Ice Nuclei Measurements; Santa

Barbara Project; Seabreeze 1957; the Mount Whittington Project; and Project Skyfire 1957. Also the results of the physical evaluation program, the knowledge gained on the value and efficiency of various types of equipment, small scale projects and techniques and the results of studies on AgI plume tracing, AgI deactivation, "overseeding," cloud electrification, etc. are summarized. (*Same item as* 11.1–178, Jan. 1960, *Met. Abs.*) *Subject Heading:* **1. Weather control.**—*I.L.D.*

**11M–823** 551.509.617:551.577.21:551.578.7:519.2

Schmid, Paul (*Zürich*), **Statistische Erwägungen bei Versuchen zur Beeinflussung der Niederschläge.** [Statistical considerations concerning precipitation modification experiments.] *Zeitschrift für Angewandte Mathematik und Physik (Zamp), Basel,* 8(2):159–165, **1957.** 3 figs., 2 refs. English summary p. 165. Also issued as *Switzerland. Eidgenössische Kommission zum Studium der Hagelbildung und der Hagelabwehr, Wissenschaftliche Mitteilungen,* No. 13, **1957.**—This report deals with the experiments to increase precipitation and to prevent hail by way of seeding the atmosphere with chemicals suited to the purpose. The statistical evaluation methods hitherto adopted are discussed, and it is shown why it is impossible to give a reliable answer to the question of the seeding results unless randomization is introduced into the scheme of the experiments. *Subject Heading:* **1. Cloud seeding evaluation.**—*English summary.*

**11M–824** 551.576.11:551.509.616

Serpolay, R., **Enseignements tirés de deux groupes d'expériences sur des stratus surfondus.** [Results of two groups of experiments on supercooled stratus.] *Puy de Dôme. Observatoire, Bulletin,* Ser. 2, No. 4:115–120, Oct./Dec. **1957.** 2 figs., 2 refs. English summary p. 115. **DWB**—An experiment carried out with silver iodide smoke on a supercooled stratus cloud has pointed out that silver idode particles can be suspended in the atmosphere for 18 hrs without their ice-forming ability being lost. The results of experiments carried out on two different supercooled stratus clouds, jointly with silver iodide smoke and pulverization of liquid propane, have allowed us to differentiate the proper turbulence of each cloud. (*Same item as* 10.1–287, Jan. 1959, *Met. Abs.*) *Subject Headings:* **1. Supercooled stratus clouds 2. Cloud seeding.**—*Author's abstract.*

**11M–825** 551.509.61:355

Sotnikov, I., **"Meteorologicheskaia voĭna" ili mozgi nabekren'.** ["Meteorological warfare" or twisted minds.] *Novoe Vremia,* Moscow, No. 52(653):18–19, Dec. 26, **1957. DLC**—The statements by Von Neumann and Houghton with respect to the potential importance of meteorological warfare or weather control on a hemispheric scale are discussed with emphasis on the psychosis that, according to the author, "leads men to propose such inhuman and irresponsible measures." *Subject Headings:* **1. Meteorological warfare 2. Weather control**—*M.R.*

**11M–826** 551.574.2:551.509.617(675)

Soulage, Guy, **Nuages équatoriaux naturels et essais de formation artificielle de cumulus précipitants.** [Natural equatorial clouds and attempts at artificial formation of precipitating cumulus.] *Puy-de-Dôme. Observatoire, Bulletin,* Ser. 2, No. 1:9–24, Jan./March **1957.** 4 figs., 3 refs. **DWB**—A report on the experiments begun by H. and J. Dessens in 1955 (*see also* 9.8–144, Aug. 1958, *MAB*) at Lukolela in the Belgian Congo (1°S, 17°E) and continued in 1956 by the author, using brush fires to produce artificial cumulus clouds and precipitation. A study of the conditions under which natural clouds form in this area is first reported. Specific instances with photographs showing clouds, formed naturally and artificially, are cited in detail for various weather types. The season of 1956 was unusually poor for such experiments. Large cumulus were induced by the brush fires, but none gave any added precipitation. (*Same item as* 9.10–232, Oct. 1958, *Met. Abs.*) *Subject Headings:* **1. Artificial cumulus formation 2. Brush fire cloud formation 3. Lukolela, Belgian Congo. I. Dessens, H. II. Dessens, J.**—*M.R.*

**11M 827** 551.578.71:551.509.616:551.576.11

Soulage, G., **Augmentations du pouvoir glaçogène de l'air réalisées au cours d'expériences de prévention de la grêle.** [Increases in the ice forming power of the air, occurring during hail prevention experiments.] *Puy de Dôme. Observatoire, Bulletin,* Ser. 2, No. 4:121–141, Oct./Dec. **1957.** 8 figs., 4 tables, 17 refs. English summary p. 121. **DWB**—A study of the increases of the ice forming power of the air, obtained by H. Dessens in his experiments of hail prevention, is described. This study has been limited to measurements of the ice forming power on the ground. It has included, on the one hand, the determination of the natural variations of the ice forming power in the absence of silver iodide smoke, on the other hand, during seedings, counts of ice crystals upwind and in the protected area. The measurements of ice forming power have been carried out with mixing clouds chambers, set in a moving laboratory and in which the ice crystals were counted after their precipitation and their growth in a solution of sugar and water. The results of these measurements make evident the sporadic character of the increases realized with the burners of the "Association d'Etudes."

Several explanations of that phenomenon are considered: a preponderant vertical diffusion, a loc inactivation of silver iodide nuclei, the narrowness of the diffusion plumes associated with a fluctuatic of the wind around its mean direction, an irregular course of the burners. Among these explanation the last two seem the most plausible. At last, the observed increases were appreciable but the multiplied the ice forming power of the air by a factor smaller than ten. (*Same item as* 10.1–30 Jan. 1959, *Met. Abs.*) *Subject Headings:* **1. Hail prevention 2. Ice forming power 3. Cloud seedir 4. France.**—*Author's abstract.*

**11M–828** 551.509.616(4

§*Spain. Servicio de Investigación y Ensayos de Lluvia Artificial, **Ensayos de lluvia artificial e el Pirineo Leridano, Periodo lo octubre 1954 a 31 mayo 1956.** [Experiments in artificial rainfall the Leridan Pyrenees, Oct. 1, 1954 May 31, 1956.] issued **1957?** 301 p. numerous figs. (son fold.), tables. **DWB** (MO9.67 S733e)—One of the most elegant reports on artificial rainfall exper ments, covering 20 months of carefully executed tests in an area mostly on the Spanish side of th Pyrenees. The work consists of 3 parts: I. Physical investigations, II. Statistical studies ar III. Month by month summary of meteorological and synoptic data pertinent to cloud seeding trial Seeding was performed with AgI during the 12 months Oct. 1954–Sept. 1955. A series of analyze synoptic charts is presented for each seeding situation. The meteorological conditions resulting natural precip. and those favorable for artificial precip. are discussed at length and illustrated wit schematic diagrams. Thermodynamic, synoptic and statistical aspects are discussed at great lengt and the text supported by beautiful charts and other illustrative material. (*Same item as* 10.11–13 Nov. 1959, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding projects 2. Statistical tests of clou seeding 3. Leridan Pyrenees, Spain.**—*M.R.*

**11M–829** 551.509.616:551.515.

Spar, Jerome (*Dept. of Met. & Oceanog., N. Y. Univ.*), **Project Scud.** *Meteorological Monograph* Boston, 2(11):5–23, July **1957.** 17 figs., 3 tables, 8 refs. **DWB, DLC**—Cloud seeding with dry i and silver iodide was conducted over the east coastal region of the U. S. during the periods January April 1953 and December 1953–April 1954, to determine the effects of seeding on cyclone develo ment. The experimental units employed were cases of potential cyclogenesis. After selection the cases, seeded and control instructions were separated by a randomization procedure in consecutiv pairs. Test variates were 24-hr area integrated precipitation and sea level pressure change. Th data were reduced by the method of analysis of covariance. It was concluded from the statistic analysis that if the seeding had any effect on the large scale precipitation or on the pressure field, th effect was too small to be detected against the background of natural meteorological varianc (*Same item as* 10.10–186, Oct. 1959, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding experimen 2. Cloud seeding effects on cyclogenesis.**—*Author's abstract.*

**11M–830** 551.509.617:551.578.4(494.

*Switzerland. Eidgenössische Kommission zum Studium der Hagelbildung und Hagelabwel **Grossversuch II zur Bekämpfung des Hagels auf der Magadinoebene, 4. Versuchsjahr.** [Project for hail control in the Magadino Plain, 4th year of experiment.] Its *Tätigkeitsbericht*, No. 9, 195 pub. **1957.** 68 p. 13 figs., 52 tables. **DWB** (M78.7 S979g, 1956)—In 1956, like in previous yea (for reports on 1953–1955 seasons *see* 11M–657 and 11M–749), a network of ground-based A generators was operated in the Magadino Plain on days with a chance of hail. The 1956 repo covers the same details as the previous ones: 1) distribution of the generators; 2) weather develo ment and thunderstorm occurrence during the report period (May 14–Oct. 13, 1956); 3) detail statistical and synoptic analysis of thunderstorms and hailstorms and 4) hail damage according insurance records. As a whole the four years of hail control experiments (and more particularly th last three years of uniform operation with automatic generators) are found to "have produced r reliable and conclusive evidence of an inhibitory effect of silver iodide seeding on hail formation Possibilities of a statistical evaluation were examined by P. SCHMID who concluded that the availab data cannot furnish significant results by any statistical method (the regression method fails becau of the poor correlation between target and control areas in the case of hail). P. Schmid (for h paper *see* 11M–823) recommends that seeding operations be organized according to a random di tribution scheme, which will be done starting with the next season (for later reports *see* 11M–89 –960 and 1011). (*Same item as* 9.2–35, Feb. 1958, *Met. Abs.*) *Subject Headings:* **1. Hail preventi in Switzerland 2. Cloud seeding with silver iodide 3. Magadino Plain, Switzerland. I. Sänger, II. Staub, H. III. Thams, J. C. IV. Schmid, P.**—*G.T.*

**11M–831** 551.509.617:519.

Thom, H. C. S., **Statistical method of evaluating augmentation of precipitation by cloud seedin** *U. S. Advisory Committee on Weather Control, Technical Report*, No. 1, June **1957.** 62 p. 16 fig 41 refs., numerous eqs. (Also included in its **Final Report,** Vol. 2: 5–25, **1957.**) **DWB**—T

general features of the regression methods of evaluation as they apply to target-control systems are discussed. Application of these requires that the residuals from regression have a constant variance for all values of control precipitation. Since raw precipitation data do not result in such regressions, a parametric transformation which transforms target and control precipitation to normality and stabilizes the residual variance is developed. The parametric character of the transformation facilitates the making of stochastic models of hypothetical evaluations and thus to perform experimental sampling on artificial precipitation data. This leads to certain inferences concerning previous evaluations and requirements for future evaluations. The simple theory of testing hypothesis is discussed with application to a hypothetical sample of storms. The evaluation method is then extended to multiple seedings and applied to an artificial sample of storms. Power curves are developed for multiple seedings for several assumed percentage increases. Transformation of hydrologic data is discussed and a method applicable to such data developed. (*Same item as* 9.9-24, Sept. 1958, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding evaluation 2. Regression techniques.**—*Author's abstract.*

**11M-832** 551.509.617:551.576.1

Thom, H. C. S., **An evaluation of a series of orographic cloud seeding operations.** *U. S. Advisory Committee on Weather Control, Technical Report,* No. 2, June **1957.** 79 p. 5 figs., 6 tables, 17 refs., 8 eqs. (Also included in its **Final Report,** Vol. 2:25–50, **1957.**) **DWB.** Also issued in summary form in Conference on the Scientific Basis of Weather Modification Studies, Univ. of Arizona, Tucson, April 1956, **Proceedings,** pub. **1956.** 2 p. And also issued separately, in mimeographed form (summary), with 4 figs. **DWB**—Evaluations on a series of 11 projects in the United States and one in France are undertaken. On the basis of past work, it is hypothesized that these should be divided into three classes: 5 orographic, 3 semi-orographic, and 4 nonorographic. The orographic and semi-orographic classes, excluding the French project, are also combined into a West Coast class with 7 projects. Meteorological analysis predicts that artificial nucleation would be effective in augmenting precipitation in orographic and West Coast classes but not in the nonorographic class. The results presented are consistent with this hypothesis. The orographic project class and the West Coast class both showed increases of 14% in precipitation which are both significant at the 0.01 level of probability. The nonorographic projects showed no significant increase. The evaluations comprised 5096 storms of historical record used in estimating 59 regression lines. These were used as bases for comparison with precipitation amounts from 386 seeded storms for the tests of significance and the determination of percentage increases. A worked out example of an evaluation for one month of storms is given in complete detail in the appendix. (*Same item as* 9.9–22, Sept. 1958, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding of orographic clouds 2. Orographic clouds 3. Cloud seeding evaluation 4. France 5. United States.**—*Author's abstract.*

**11M-833** 551.509.617:551.578.7(494.5)

Thom, H. C. S., **A method for the evaluation of hail suppression.** *U. S. Advisory Committee on Weather Control, Technical Report,* No. 4, June **1957.** 42 p. 4 figs., 5 tables, 12 refs., 46 eqs. (Also included in its **Final Report,** Vol. 2:55–69, **1957.**) **DWB.** Also in: *Zeitschrift für angewandte Mathematik und Physik,* Basel, 9(1):37–63, Jan. **1958. DLC**—A sequential test of hypothesis is developed for testing the hypothesis that hail suppression operations reduce the frequency of hail-days. This is applied to the data provided by suppression trials over the Magadino Plain in Switzerland. Operating characteristic and average sample number functions are also developed and applied to hail data from the Magadino Plain. Implications of the methods and test results are discussed. (*Same item as* 9.9–23, Sept. 1958, *Met. Abs.*) *Subject Headings:* **1. Hail prevention in Switzerland 2. Magadino Plain, Switzerland.**—*Author's abstract.*

**11M-834** 551.509.6:551.574.1:016

†Thuronyi, Geza; Sze, Marina and Nupen, Wilhelm (*comps.*), **Bibliography on weather modification and cloud physics.** Ed. by Malcolm Rigby. (In: U. S. Advisory Committee on Weather Control, **Final Report, 1957,** pub. **1957.** 2:322–409. 2259 items. Author, subject and geographic indexes.) **DWB, DLC**—Several bibliographies on cloud physics, cloud seeding, atmospheric nuclei, radar cloud physics and weather modification published in **MAB** were combined and scores of new items from all over the world were added to compile this author-title-journal bibliography of 2259 items, plus an author, subject and geographic index. Citations are arranged chronologically within the 6 major subject areas (corresponding to the major chapters in the **Final Report**). These headings are: I. Texts and general works; II. Statistical evaluation of cloud seeding operations and potentialities; III. Physics of cloud and precip.; IV. Legal aspects; V. Economic aspects; VI. Special hail, lightning, cloud and fog suppression and atomic explosion effects. Under Sec. III there are 7 subheadings: 1. cloud seeding theories, 2. nuclei, 3. formation and properties of cloud particles, 4. . . . of clouds, 5. . . . of precip., 6. . . . thunderstorms, 7. radar cloud and precip. studies. (*Same item as*

9.8–47, 1958, *Met. Abs.*) *Subject Headings:* **1. Weather modification bibliographies 2. Clou physics bibliographies.**—*M.R.*

**11M–835** 551.509.6

U. S. Advisory Committee on Weather Control, **Brief summary of reports and activities connection with evaluation programs (and) Letter to the President.** June 28, 1957. 52 p. Mimeo **DWB** (MO9.67 U581b)—A brief summary of work done under Operation Overseed, Project Skyfi and Project Seabreeze, and in ice nuclei measurement, the Santa Barbara project, and the statistic evaluation program during 1955–56–57, under the supervision of the Advisory Committee on Weath Control. *Subject Headings:* **1. Cloud seeding evaluation 2. Weather control.**—*M.R.*

**11M–836** 551.509.617(0

†U. S. Advisory Committee on Weather Control, **Final report.** Letter of transmittal, Dec. 3 **1957.** 2 vol. (32+422 p.). Vol. 1, **Findings and recommendations.** Vol. 2, **Technical report** figs., photos, tables, refs., bibliogs. Vol. 2, Appendix D, **Bibliography on weather modification ar cloud physics,** comp. by Geza Thuronyi, Marina Sze and Wilhelm Nupen; ed. by Malcolm Rigb (*See* 11M–753, –758 to –760, –765, –766, –780, –785, –787, –788, –791, –812, –819, –822, –831 to –83 –840, –841 and –847.) (For listing of articles, *see* 9(4):512–513, April 1958, *Met. Abstracts.*) **DW** —The first Vol. of this final report on the history, personnel activities, and reports contains th Committee's findings and recommendations emanating from 3 years of intensive and extensiv investigations and studies. Vol. II is composed of 6 technical reports on statistical evaluation, number on physical evaluation, one on the legal and one on the economic aspects, and a number o special local evaluation projects, etc. A bibliography of 2259 references to the world's literature arranged in the general form of the report itself. The bibliography contains a detailed subject ar geographic index and an author index. The major statistical conclusions were: 1) that up to 10–15 more precip. can be squeezed out of seeded clouds on the Pacific Coastal Ranges of the U. S. durin winter storms; 2) In nonmountainous parts no significant proof of either increase or of no increas could be found; 3) no negative effects (overseeding) could be detected; 4) no conclusions could b reached regarding heat suppression. The physical evaluation conclusions are briefly: 1) AgI seedin from ground generators is a valid technique but won't necessarily produce results; deactivation b sunshine and heat is negligible; enough AgI can be found 30 mi away (in some cases) to produc seeding effects; and 2) physical measurements in clouds indicate that sometimes there is a deficienc of natural ice forming particles. (*Same item as* 9.8–1, Aug. 1958, *Met. Abs.*) *Subject Heading* **1. U. S. Advisory Committee on Weather Control 2. Cloud seeding evaluation. I. Orville, Howar T.**—*M.R.*

**11M–837** 551.509.616:342.

U. S. Congress. Senate. Committee on Interstate and Foreign Commerce, **Experiment research program in cloud modification. Hearings before a Subcommittee . . . 85th Congress, 1s session on S. 86, a Bill to provide for an experimental research program in cloud modificatio** March 26 and May 13, **1957.** Wash., D. C., U. S. Govt. Print. Off., **1957.** 202 p. **DWB** (MO9.6 U581ex)—This complete transcript of subcommittee hearings on a proposed research program i weather modification contains extensive testimony by authorities on various aspects of the fie representing government agencies, research institutions and commercial or industrial organization The statements prepared or given under questioning cover results achieved in the past in scientif experiments and commercial operations, method of evaluating cloud seeding effectiveness, researc objectives for the future, legal and legislative problems, activities of the Advisory Committee o Weather Control, etc. Numerous reports and letters containing a variety of data are include making this document one of the most extensive and diversified single sources of information on weath er modification. (*Same item as* 10.10–62, Oct. 1959, *Met. Abs.*) *Subject Headings:* **1. Cloud modifica tion research 2. Congressional hearings on weather control.**—*G.T.*

**11M–838** 551.509.6:061.2(73

U. S. National Science Foundation, **National Science Foundation announces $1,130,000 researc program on weather modification.** Its *Release,* March 23, **1957.** 4 p. Mimeo. **DWB** (MO9. U5847na)—Notes on the 13 NSF grants for laboratory research, field work evaluation and confe ences on weather modification during fiscal 1959, with a total cost of $1,130,000. The program wa established on July 7, 1958 under PL 510 of the 85th Congress. Techniques of physics, chemistr and mathematics or statistics, equipment such as the electron microscope, seeding materials such a AgI, lampblack and other heat absorption agents or electrical charge inducers are employed. Amon those awarded grants for field investigations are: HORACE R. BYERS and ROSCOE R. BRAHAM o University of Chicago; A. R. KASSANDER, L. J. BATTAN and J. E. MCDONALD of University o Arizona; R. D. ELLIOTT of Goleta, California; D. B. KLINE of U. S. W. B.; the atmospheric Researc group of Pasadena, California; BERNARD VONNEGUT of A. D. Little, Inc., and others. H. B. BYER

of University of Chicago received a 3-year grant for laboratory research in cloud physics with some field research to test results obtained in the laboratory. Two grants were made for statistical evaluation (U. of Calif., Berkeley and N. Y. Univ.). Three grants were made for conferences (Am. Geophysical Union, Nat. Acad. of Sciences-Nat. Research Council, and Foundation for Instrumentation Education and Research). *Subject Headings:* **1. Weather modification projects 2. National Science Foundation grants for weather modification 3. Cloud physics research.**—*M.R.*

**11M–839** 551.509.617

Vancea, N., **Precipitaţiile artificiale.** [Artificial precipitation.] *Meteorologia si Hidrologia*, Bucharest, 2(1):35–42, Jan./March **1957. DWB**—Three World Meteorological Organization publications are summarized: Technical Notes No. 1 and 13 (1954, 1955) and an article in the Jan. 1956 issue of WMO Bulletin (for abstracts on originals, *see* 11M–573 and 11M–670.) *Subject Heading:* **1. Artificial precipitation.**—*G.T.*

**11M–840** 551.509.25:551.577.2 551.509.617

Visscher, Hubert B.; Funke, P. Walter and Pina, Raymond M., **The Atlanta Project for study of flatland cloud seeding.** (In: U. S. Advisory Committee on Weather Control, **Final Report, 1957,** pub. **1957.** 2:257–263. 14 figs.) **DWB, DLC**—The effectiveness of flatland cloud seeding from ground generators involved the establishment of a grid 400 miles on a side and oriented in such a way that the gradient wind always flows in a particular direction along the grid. In addition to a group of real ground seeding generator projects also dummy projects in which no seeding was performed were selected. Bias was eliminated by not giving any clue to the investigators as to which projects were real and which were dummy. A detailed account is given of the procedure for analyzing rainfall patterns, including the nature of rainfall data, plotting of the observations, adjustment of the observations to the period of maximum rainfall in the grid area, synoptic analysis and classification of cases into frontal and non-frontal categories; grid analysis, and the construction of real and dummy composite charts. An analysis of the results indicates that the dummy composite charts showed patterns that differed consistently from the composite charts of the real generators. They reflected positive precipitation anomalies which occurred downstream of the generators, but showed few of the specific features discernible in the real projects, connecting the rain percentage maxima with the generator areas, along the mean wind. All composite maps of real generators showed isohyetal patterns entirely compatible with meteorological conditions associated with a positive precipitation anomaly emanating from the generator areas. *Subject Headings:* **1. Cloud seeding evaluation 2. Rainfall analysis 3. Rainfall composite charts.**—*I.L.D.*

**11M–841** 551.574.2 551.509.616:546.57:546.15

Vonnegut, Bernard, **Early work on silver iodide smokes for cloud seeding.** (In: U. S. Advisory Committee on Weather Control, **Final Report, 1957,** pub. **1957.** 2:283–285.) **DWB, DLC**—The early work on the use of silver iodide for seeding clouds in the natural atmosphere involved the development of AgI generators and the evaluation of the nuclei output of the various generators. The various methods of making and dispersing AgI described by the author are: production of small AgI particles by mechanical agitation; vaporization of AgI at high temperature and rapidly condensing the vapor at very small particles; using fire works filled with AgI; use of a generator consisting of a hot gas flame into which a string coated with AgI was fed; generators converting solutions of AgI dissolved as a complex with other silver iodides; involving combustion of various solid fuels impregnated with AgI; ignition of pieces of charcoal impregnated with AgI and dropping from an airplane; atomizing of a hot solution of AgI in an acetone flame. Two techniques for evaluation rate of nuclei output by AgI generators are described; namely, operating the generator at the entrance to a wind tunnel so that the entire output is mixed with clean air; withdrawing samples of air containing AgI and testing it at various temperatures in the cold box and measuring the output of a generator which operated in a large room or building, and testing samples in a cold box. (*Same item as* 12.2–252, 1961, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with silver iodide 2. Silver iodide smoke generators.**—*I.L.D.*

**11M–842** 551.509.616(98)

Voskresenskiĭ, A. I.; Morachevskiĭ, V. G. and Nikandrov, V. Ia., **Primenenie tverdoĭ uglekisloty dlia rasseivaniia oblakov v Arktike.** [Use of dry ice for cloud dispersal in the Arctic.] *Problemy Arktiki*, Leningrad, No. 2:133–139, **1957.** 2 figs., table. Transl. into English issued as U. S. Joint Publications Research Service, **Arctic and Antarctic: Selected translations from Soviet-bloc IGY literature** issued April 13, 1959. p. 11–19. (OTS 59–11, 505; JPRS 651-D). **DWB** (919.U584ar)—Experiments of fog dispersal from aircraft are described, as organized by the Arctic Institute in the summer of 1956. Result of the 21 operations was the achievement of complete dispersal of stratus and stratocumulus clouds and fogs with a thickness up to 500 m, and a wind velocity up to 10 m/s, using solid carbon dioxide at temperatures of −4° and lower. The zone of clearance amounts to up

to 50 km² lasting up to an hour with a flight pattern lasting 11 minutes and an expenditure of 50–250 of solid carbon dioxide per km of flight. The distribution of the number of days with fog in the period of navigation in various sectors of the Soviet Arctic is presented in a table. The appearance of light and gaps in clouds at the end of 10 minutes after the action are illustrated. *Subject Headings:* **1. Artificial cloud dispersal 2. Cloud seeding in Arctic 3. Soviet Arctic.**—*O.T.*

**11M–843** 551.578.7:551.509.616:546.57:546.15

Weather Engineers, Inc., Sacramento, Calif., **Hail suppression operations in the North Platte Valley of Nebraska—in the air, and on the ground, 1957 season.** pub. **1957.** 27 p. 8 figs., 4 tables, 10 refs. Mimeo.—Preliminary results of hail suppression operations conducted in the North Platte Valley in 1957, by means of ground-based silver iodide generators and four aircraft carrying AgI generators, are reported. The evaluation was done on the basis of a correlation found between total precipitation and hail damage in that area. Hail damage in 1957 was found to be considerably below the amounts to be expected from that correlation. In terms of economic value this is claimed to represent a return of 90 to 1 on the investment in hail suppression operations. (*Same item as* 12.2–253, 1961, *Met. Abs.*) *Subject Headings:* **1. Hail prevention in Nebraska 2. Cloud seeding with silver iodide 3. North Platte Valley, Nebr.**—*G.T.*

**11M–844** 551.509.616:551.578.71

Weickmann, H., **Current understanding of the physical processes associated with cloud nucleation.** *Beiträge zur Physik der Atmosphäre*, Frankfurt a.M., 30(1):97–118, **1957.** 5 tables, 19 figs. (incl. photos). German, French and English summaries p. 97. Special abstract in English, p. 118. **DWB, DLC**—Cloud dissipation experiments, AgI seeding to produce rainfall and hail prevention possibilities are discussed and illustrated graphically and quantitatively in text and tables. The author discovered that 1g of dry ice would generate near $10^9$ ice crystals at −10°C (not $10^{16}$ as Langmuir claimed for −20°C). A graph shows number of ice crystals formed by AgI, $CdI_2$ and $CoI_2$ at temperatures of 0° to −20°C and natural nuclei at −10° to −33°C. Formation of artificial warm front and artificial shower precipitation are also discussed at length. Modest increases may be attained in warm front clouds by increasing markedly the number of nuclei. This will tend to increase the showery activity in these clouds and the increase in precipitation will be proportional to the natural rate of precipitation. Increase in number of freezing nuclei in shower clouds might also increase the amount of hail particles and thus the precipitation. It is believed that any attempt at hail prevention by seeding would increase the probability of hail, but more research is needed. (*Same item as* 10.9–163, Sept. 1959, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with silver iodide 2. Artificial cloud dispersal 3. Hail prevention.**—*M.R.*

**11M–845** 551.509.617:551.577.11

Weickmann, H. K. (*Signal Corps Eng. Labs.*) **Physics of precipitation.** *Meteorological Monographs* (*American Meteorological Society*), 3(12/20):226–255, July **1957.** 23 figs., 6 tables, bibliog. p. 253–255, 20 eqs. **DWB, DLC**—Artificial increase of precipitation is discussed on p. 244. No objective method has been found to directly measure the seeding activities. It would take decades of careful experiments to obtain a clear answer because of the great variability of the rate of precipitation. The potentialities of rainmaking were over-estimated in the past. On the seedability of thunderstorms, as stated on pp. 248–249, it is impossible to estimate the artificially influenceable rate of precipitation. We do not know enough about hail formation to be able to see the possibilities of hail prevention by seeding, it is asserted on p. 252. (For abstract on article as a whole *see* 9.11–246, Nov. 1958, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Precipitation physics.**—*I.S.*

**11M–846** 551.509.615:629.13

West, David, **Fido was no dog.** *Flying*, N. Y., 61(12):26–27, 62, 74, Aug. **1957.** photos. **DWB**—Fido stands for fog investigation dispersal operation and was responsible for more than 2,500 aircraft (10,000 men) of the allied forces landing safely in spite of adverse fog conditions during Nov. 19, 1943 and V-day. German meteorologists rightly predicted heavy fog over England and were greatly surprised because of almost "normal" flight activity. Fido consisted of parallel lines of petroleum burners placed 50 yds from each edge of the allied runways, dispersing the fog in 15 min with a fuel consumption of 75,000 gph. *Subject Headings:* **1. Fog Investigation Dispersal Operation (FIDO) 2. Artificial fog dissipation.**—*W.N.*

**11M–847** 551.509.617:551.577.2

Woodbury, Max A. and Klein, Eleanor, **Final report of the statistical weather advisory project (of) New York University College of Engineering Research Division.** (In: U. S. Advisory Committee on Weather Control, **Final Report, 1957,** pub. **1957.** Vol. 2:86–91. eqs.) Reprinted from *U. S. Advisory Committee on Weather Control, Technical Report*, No. 6. **DWB, DLC**—This report is concerned with the methodology of the statistical evaluation of the effectiveness of cloud seeding opera-

tions in South Dakota carried on during May, June, July and August. The various computations for evaluating the effect of seeding upon precipitation are described. These are as follows: (1) examination of a possible trend of rainfall over time by testing the hypothesis that there is no historic polynomial trend to rainfall and temperature, analyzing the variance of the successive orthogonal polynomials of the regression analysis compared by city and month and by using a modified form of Bartlett's test of homogeneity of variance; (2) examination of the relation of sunspots to precipitation and temperature, involving correlation, regression, relation over time, correlation coefficients, and stepwise regression; and (3) numerical prediction of rainfall over an area. The computational procedure of the last method is presented and the results obtained with the various statistical procedures are summarized. (*Same item as* 11.2–161, Feb. 1960, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding evaluation 2. Cloud seeding effectiveness 3. Numerical rainfall forecasting 4. South Dakota.**—*I.LD.*

**11M–848** 551.509.68:551.541:623.454.8

Yamamoto, R. (*Met. Res. Inst., Kyoto Univ., Kyoto*), **A dynamical theory of the microbarographic oscillations produced by the explosions of hydrogen bombs.** *Meteorological Society of Japan, Tokyo, Journal, Ser.* 2, 35(5):288–296, Oct. **1957.** 7 figs., 5 tables, 8 refs. 6 eqs. **DWB, DLC**—A simplified theory of the external gravity waves in compressible fluid is presented, and some dynamical tools which are useful for analysis of the recorded microbarographic oscillations due to the hydrogen bomb explosions are obtained. A theoretical contradiction of nonexistence of the waves with periods shorter than ca. 1.5 min, which arises when the two-layer model is adopted, is resolved by introducing the warm ozonosphere as the uppermost layer of four-layer model. (*Same item as* 10.4–140, April 1959, *Met. Abs.*) *Subject Headings:* **1. Microbarograph oscillations 2. Thermonuclear explosion effects on atmospheric pressure.**—*Author's abstract.*

**11M–849** 551.509.617(68)

**Can man control the rain?** South Africa. *Weather Bureau, News Letter*, No. 103:1–3, Oct. 31, **1957. DWB**—An article intended to inform the public and especially the farmer as to the potentialities of cloud seeding for providing rain during dry weather. Natural rain is first discussed, then artificial rain, experiments in USA, Australia, and South Africa, commercial exploitation, hail prevention and methods of evaluation. Conclusions are quoted from WMO report "Artificial Control of Cloud and Hydrometeors." (1955) (*See* 11M–670). *Subject Headings:* **1. Cloud seeding potentialities 2. South Africa.**—*M.R.*

**11M–850** 551.574.1:551.509.616/7

**The physical basis of cloud modification.** (In: U. S. Advisory Committee on Weather Control, **Final Report, 1957,** pub. **1957.** 2:320–321. 3 figs.) **DWB, DLC**—A non-technical and qualitative description of the physical processes of the formation of precipitation in the temperate and high latitudes, the formation and growth of freezing nuclei, the existence of subcooled waterdrops, the initiation of precipitation in subcooled cloud systems by seeding with dry ice, silver iodide, etc. and the temperature and cloud conditions favoring artificial precipitation, artificial rain formation in tropical clouds, etc. A graph showing temperature activity of foreign particles serving as nuclei for ice crystal formation and diagrams illustrating the initiation of precipitation by seeding are presented. *Subject Headings:* **1. Artificial cloud modification 2. Precipitation formation.**—*I.L.D.*

## 1958

**11M–851** 551.509.617(914)

Abello, Ronrigio, **Notes on rain stimulation.** *Philippines Sugar Technologists, 6th Annual Convention 1958, Proceedings.* p. 330–334, pub. **1958.** 3 figs. **DA** (65.9 P534)—A report on the full success of the first experiment of "rainmakers" from the United States in the Philippines is presented. The Vidorias Milling Company was in charge of the experiments in Negros Province, which produced an average of 2.7 inches of rain from February 19 to March 11, 1958. Based on literature of the General Electric experiments, principles of cloud seeding theory, silver iodide production, and silver iodide generator are explained, accompanied by an evaluation of weather modification operations. A sketch illustrates silver iodide ground generator in action. *Subject Headings:* **1. Cloud seeding effectiveness 2. Cloud seeding with silver iodide 3. Negros Province, Philippines.**—*O.T.*

**11M–852** 551.509.615

Aeroprojects Inc., West Chester, Pa., **Proposal to investigate new techniques in fog dispersal.** Submitted to U. S. Weather Bureau, Wash., D. C., March 21, **1958.** 16+27 p. figs., photos, 19 refs. **DWB** (M09.615 A252pr)—It is proposed that a feasibility study be undertaken in which aerosols in controlled quantities will be used in fog dissipation. A literature review and bibliography are included. The contractors' approach, rationale, and technical background are described. A

statement of planned work explains the plans for laboratory feasibility study, small-scale and actual field tests to be made if the contract is obtained. *Subject Headings:* **1. Fog dispersal techniques.** —*E.Z.S.*

**11M–853** 551.509.617(795)

Barton, Manes and Calvin, Lyle D., **Evaluation of cloud-seeding efforts in the southern Oregon cascades, 1952–1957.** *Western Snow Conference, April* 1958, *Proceedings*, Vol. 26 pub. Oct. **1958.** p. 66–73. 4 figs., 6 tables, 7 refs. **DWB** (M(06) W527p)—For seven years (1952–1958) the North American Weather Consultants conducted cloud seeding operations for the California Oregon Power Company in order to increase the mountain snowfall and consequently, the summer stream flow for the production of hydroelectric power. During these years there has been a noticeable increase percent-wise in the average snow water content, the precipitation and the streamflow. The highest percent of normal precipitation during four of the seeded years occurred in the Fremont-Paisley area. This strongly supports the thesis that a downwind effect exists beyond the target area. (*Same item as* 11.1-180, Jan. 1960, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding evaluation 2. Cloud seeding in Oregon.**—*N.N.*

**11M-854** 551.509.616:551.576.11(79)

Battan, Louis J.; Kassander, A. Richard and Sims, Lee L., **Randomized seeding of orographic cumuli, 1957, Pt. 2.** *Arizona. Univ. Institute of Atmospheric Physics, Scientific Report* No. 9, Oct. 1, **1958.** 11 p. 4 figs., 10 refs. **DWB** (M08.21 A719s)—During July and Aug. 1957, orographic cumuli over the Santa Catalina Mts. of southeastern Arizona were seeded from an airplane with silver iodide. The experimental design of the program involved the randomized seeding by pairs of days; one of two days with suitable clouds was seeded on a random basis. On seven pairs of days, observations were made of the cumuli with a pair of K-17 cameras on a 1.3 mi baseleg. At the same time, radar observations were made with a 3-cm vertically-scanning radar set. On the basis of the analysis of the camera and radar observations an investigation has been made of the occurrence of precipitation as a function of cloud size and temperature. It was found that there is a large variability in cloud behavior from year to year. Natural clouds in the arid southwest do not produce precipitation until their vertical thicknesses are of the order of at least 8 to 10,000 ft. From a comparison of seeded and non-seeded clouds it appears that the silver iodide particles may have produced changes in the precipitation formation mechanisms in orographic cumuli. (*Same item as* 10.6–157, June, 1959, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding of orographic clouds 2. Cloud seeding evaluation 3. Cloud seeding with silver iodide 4. Santa Catalina Mountains, Arizona.**—*Authors' abstract.*

**11M–855** 551.509.6(73)

Bell, G., **Bericht über den Stand der Wetterbeeinflussung in den Vereinigten Staaten von Amerika.** [Report on the present status of weather control in the U. S. A.] *Meteorologische Rundschau*, Berlin, 11(6):185–187, Nov./Dec. **1958. DWB, DLC**—The conditions in the U. S. leading to the establishment of the Advisory Committee on Weather Control in 1953, the task of the Committee and the most important conclusions reached in the **Final Report** in 1957, are summarized briefly. The membership of the Committee is listed. The author then presents a translation of the summary of the results, and of the recommendations for general meteorological research. (*Same item as* 11.1–176, Jan. 1960, *Met. Abs.*) *Subject Headings:* **1. Weather control in U. S. 2. United States.**—*I.L.D.*

**11M–856** 551.509.6

Bello, Francis, **Forecast for weather control: brighter.** *Fortune*, N. Y., 57(5):144–147, 166–168, etc., May **1958.** figs. **DLC**—A well-written and colorfully illustrated article on what has been done along lines of weather control in the U. S., and prospects for future developments in this field. Schematic illustrations show how ground based AgI generators operate to transform supercooled clouds into precipitation producing clouds, and how warm cumulus clouds may be seeded from above by an airplane to produce showers, and colored charts of the U. S. show where rainmaking would be more or less effective or where hail storms, tornadoes and hurricanes might be suppressed, and where inconclusive experiments have been performed in various parts of the country. Possibilities such as melting of ice by decreasing the albedo, increase in research, use of satellites and electronic computers are discussed. (*Same item as* 10.9–160, Sept. 1959, *Met. Abs.*) *Subject Headings:* **1. Weather control 2. Cloud seeding.**—*M.R.*

**11M–857** 551.509.617:546.57:546.15

Berenbach, Larry O., **Rainmaking.** *Better Farming Methods*, Mount Morris, Illinois, 30(4):15–17, April **1958.** fig. **DA** (58.8 B46)—Increasing rainfall, increasing snowpack in mountain regions,

suppression of hail, suppression of lightning and the prospective possibility of suppression of tornadoes and diverting hurricanes are listed as activities of weather modification. The possibilities of rain increase and the beginning of cloud seeding and of experimental research are retraced to 1896, and 1946 respectively. The zone between 25°F and 5°F is identified as that in which silver iodide will form ice crystals, i.e., where the water content can be affected by silver iodide nucleation. *Subject Headings:* **1. Progress in weather control 2. Cloud seeding with silver iodide.**—*O.T.*

**11M–858** 551.509.617

Berenbach, Larry O., **An expert tells how cloud seeding works.** *Better Farming Methods*, Mount Morris, Illinois, 30(5):22–26, May **1958.** 4 figs. **DA** (58.8 B46)—A popular presentation of cloud seeding operations. It is stated that five out of six cloud seeding projects produced increased rainfall. Rainfall from a natural storm can be increased, hail can be decreased, but no rain can be created from a clear sky. Silver iodide rain production is explained and illustrated. Cloud seeding control, operating weather control, hail suppression, and the Weather Control Committee are discussed. *Subject Heading:* **1. Cloud seeding effects.**—*O.T.*

**11M–859** 551.509.61

Bossolasco, Mario, **Vedute sull'influenzamento artificiale dei fenomeni meteorologici.** [Artificial modification of meteorological phenomena.] *Geofisica e Meteorologia*, Genoa, 6(1/2):13–17, April **1958.** 4 refs. **DWB**—The author discusses the artificial modification of climate, in particular precipitation, by controlling evaporation on limited areas of sea surface near continents. By seeding a given surface with particular nuclei, which will be evaporated into the air, hail can be prevented. The role of sand transported by winds at altitudes of 3000 to 9000 m across Europe as far as Poland, in the formation of late winter and spring rains, is discussed. The minute sand particles capture water vapor, other particles rising to higher altitudes are transformed into ice nuclei and from cumulus and stratocumulus clouds precipitation can be initiated more easily. A modification of the Sahara surface would have an effect upon the rainfall regime of Europe. (*Same item as* 10.11–127, Nov. 1959, *Met. Abs.*) *Subject Headings:* **1. Evaporation control 2. Artificial precipitation 3. Artificial influences on weather.**—*I.L.D.*

**11M–860** 551.509.617:551.585.53

Bowen, E. G. (*Div. of Radiophysics, C. S. I. R. O., Sydney, New South Wales*), **The artificial stimulation of rainfall and its application to the arid regions.** *UNESCO, Arid Zone Research*, 11:269–271, pub. **1958.** 2 figs. French summary, p. 271. **DWB** (M84 US8cl)—The discussion of the artificial stimulation of rainfall and its application to the arid regions is preceded by explanations of the formation of natural rain, freezing nuclei in the atmosphere and description of laboratory experiments on artificial nucleation. *Subject Headings:* **1. Freezing nuclei 2. Artificial nucleation 3. Arid Zone Research.**—*E.Z.S.*

**11M–861** 551.509.617:551.515.22

Braham, R. R., Jr. and Neil, E. A. (*Dept. of Met., Chic. Univ.*), **Modification of hurricanes through cloud seeding.** *U. S. Weather Bureau, National Hurricane Research Project Report*, No. 16, May **1958.** 12 p. 2 tables, 6 refs. **DWB** (M15.2 U5845r)—This report is a description of the technology of cloud seeding, namely: theory and methods of dry ice and AgI seeding, number of nuclei produced, optimum seeding rates, deactivation of AgI smoke, etc. Other seeding agents are mentioned, especially liquid nitrogen (which is not recommended, however, because of difficulties of disposal). Considering the possibility of a useful application of cloud seeding to hurricane modification, the authors state that "initial seeding experiments in hurricanes must be of an exploratory nature with the view that it is unlikely that any definitive conclusions will come from them, but with the hope that they will reveal certain aspects of the storm makeup which then may be studied at length." (*Same item as* 10.8–171, Aug. 1959, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding techniques 2. Cloud seeding effects on hurricanes 3. Hurricane modification by cloud seeding 4. Hurricane studies.**—*G.T.*

**11M–862** 551.509.617:551.574.2:546.57:546.15

Carreras-Patxot, Rafel and Sänger, Raymund (*both, Swiss Federal Inst. of Technology, Dept. of Physics, Zurich*), **A method for studying the diffusion of silver iodide particles in the atmosphere by means of $I^{131}$.** *Zeitschrift für Angewandte Mathematik und Physik*, Basel, 9a(4):375–380, **1958.** 5 figs., 3 refs. Note: Paper presented at the 3rd International Symposium on Atmospheric Condensation Nuclei, Cambridge, England, July 16–18, **1958.** **DLC**—The silver iodide as used in cloud seeding was experimentally marked with radioactive $10^{-17}$ curie iodine 131 in order to ascertain what happens to the vapor after it leaves the generator. A refined chemical method, described in detail, enabled detection of silver iodide at several hundred meters distance from the generator. This

sensitive method is quite different from the conventional freezing chamber method. However, neither method has solved the problem. (*Same item as* 12.1 264, Jan. 1961, *Met. Abs.*) *Subject Headings:* **1. Silver iodide diffusion 2. Radioactive nuclei.**—*W.N.*

**11M–863** 551.509.617

Day, John A. (*Dept. of Physics, Univ. of Redlands, Calif.*), **Cloud seeding: hope or hoax?** *Water and Sewage Works*, San Marino, Calif., 105(5):207–209, May **1958. DLC**—A popular lecture reviewing the history of rainmaking (scientific and pseudo-scientific) throughout recent centuries and the possibilities of present techniques paying off or being consciously or unconsciously a "hoax." Promises and evaluation may both be influenced by subjective judgment, especially where profits are concerned. Ignorance also plays a part. Future lies in research and better understanding. (*Same item as* 11.1–181, Jan. 1960, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding potentialities.**—*M.R.*

**11M–864** 551.574.2:551.509.617(675)

Dessens, Henri; Serpolay, Roger and Soulage, Guy, **Chutes de neige provoquées à retardement par ensemencement en iodure d'argent.** [Snow falls induced by delayed effect of silver iodide seeding.] *Académie des Sciences, Paris, Comptes Rendus*, 246(2):292–295, Jan. 13, **1958.** 2 figs., 5 refs. **DLC**—Favorable meteorological conditions have limited the diffusion of silver iodide particles, and conserved their ice-forming effectiveness after 14 hrs in the atmosphere. In certain conditions, confirmation is obtained that the effectiveness of silver iodide seeding can be manifested through the release of precipitation at a distance of several hundred km from the seeding spot. (*Same item as* 10.1–281, Jan. 1959, *Met. Abs.*) *Subject Headings:* **1. Condensation physics 2. Cloud seeding with silver iodide 3. Les Landes, France.**—*A.V.*

**11M–865** 551.574.2:551.509.617

Dessens, H., **Etude des conditions d'ensemencement des nuages par générateurs au sol à Lukoléla.** [Study of cloud seeding conditions by ground generators at Lukolela.] *Puy de Dôme. Observatoire, Bulletin*, Ser. 2, No. 2:43–56, April/June **1958.** 6 figs., 17 refs. French and English summaries p. 43–44. **DWB**—In order to obtain the optimum conditions for a local increase in rain in Central Africa, it is proposed to use only a single intense source of AgI nuclei and permanent operation of this source. The first experimental season (July–August 1957) was marked by unexpected results: additional precipitation of the order of 100% in the experimental area and to the S.-E. of this area (in the mean direction of the winds below 1.700 m) and of the order of 500% to the N.-W. of the area (in the mean direction of the winds between 1.700 m and 5.000 m). The extreme rarity of ice-forming nuclei in Central Africa and the fact that these results proceed not only from one disturbance but from several which have led to similar showers being repeated, provides some evidence in support of the assumption that seeding operations were effective; but the natural inconsistency of rain in the dry season and the uncertainty of historical records must lead us to consider them with caution. The conditions summarized above have been observed only approximately in 1957, we intend to repeat experiments in 1959 with a more powerful source which would work permanently. *Subject Headings:* **1. Condensation physics 2. Artificial precipitation 3. Lukolela, Belgian Congo.**—*Author's abstract.*

**11M–866** 551.509.617:551.578.7(44)

Dessens, H., **Les expériences de prévention de la grêle poursuivies en France.** [Experiments on hail prevention in France.] (In:Simposio Internazionale sulla Fisica delle Nubi e Relative Applicazioni all'Agricoltura, Asti, Italy, April 1958, **Atti,** pub. Dec. **1958.** p. 86–90. 10 refs. French, Italian and English summaries p. 90).—The severe hail forms in cumulonimbus clouds containing large quantities of supercooled water and displaying a great vertical development. At present, it is not certain that with ground generators a sufficient density of silver iodide particles can be obtained to prevent supercooling. But observations have shown that it is possible to prevent the extensive vertical development of cumulonimbus clouds. To solve this problem, it is necessary to carry out aerological research over the area to be protected as well as physical studies on the high efficiency production of active nuclei. (*Same item as* 11.9–232, Sept. 1960, *Met. Abs.*) *Subject Headings:* **1. Hail prevention in France 2. Cloud seeding with silver iodide 3. Silver iodide smoke generators.**—*Author's abstract.*

**11M–867** 551.509.615:629.13

Downie, Currie S. and Smith, Robert B., **Thermal techniques for dissipating fog from aircraft runways.** *U. S. Air Force. Cambridge Research Center, Air Force Surveys in Geophysics*, No. 106, Sept. **1958.** 38 p. fig., table, 11 refs. **DWB, DLC**—Several techniques for dissipating fog over aircraft runways when ambient temperatures are warmer than 25°F utilize large quantities of heat. A FIDO installation would be more reliable than other dissipation techniques, but would require a

large capital investment. The use of exhaust heat from jet aircraft engines has been proposed as an alternative to FIDO, because of comparatively minor fixed installation costs and reduced operating costs. The utilization of jet aircraft has the added advantage of maximum flexibility and an emergency capability at all USAF bases having jet aircraft. At Thule Air Base, Greenland, a FIDO installation to clear 7500 ft by 300 ft by 200 ft vertically would represent a capital investment of perhaps $2,000,000 and cost about $150 per min. of operation. Using surplus jet aircraft, the capital investment would be about $300,000, exclusive of aircraft cost, while operating costs would be somewhat less than for FIDO. (*Same item as* 10.6–93, June 1959, *Met. Abs.*) *Subject Headings:* **1. Artificial fog dissipation 2. Airport visibility.**—*Authors' abstract.*

**11M–868** 551.509.61:551.577.37:551.509.3

Elliott, Robert D. (*North American Weather Consultants*), **California storm characteristics and weather modification.** *Journal of Meteorology*, Boston, 15(6):486–493, Dec. **1958.** 2 figs., table, 17 refs., 9 eqs. **DWB, DLC**—In connection with cloud seeding projects in Pacific Coast states, detailed analyses have been prepared of many storms. From this material, average values of significant parameters have been computed and are employed to construct a model of typical cold-front-type occlusion moving into the California coast from the west, a type of storm responsible for a substantial fraction of California precipitation. The model shows some deviations from the classical cold-front-type occlusion, such as the absence of a discernible elevated warm-front surface within 150 mi of the surface cold front. The system is discussed as a steady-state mechanism wherein the generation of liquid moisture in vertical currents is balanced by its removal through precipitation, primarily in the instability zone near the surface front, and by evaporation, primarily in the altostratus zone in advance of the instability zone. The system being treated as an engine for the production of precipitation reaching the ground, its efficiency is discussed on the basis of simplified calculations of growth of precipitation in relation to ice-forming nuclei supply. It is shown that in this storm model efficiencies are normally well below 100%, and that the introduction of artificial ice-forming nuclei can raise this efficiency markedly. (*Same item as* 10.7–178, July 1959, *Met. Abs.*) *Subject Headings:* **1. Storm rainfall 2. Cloud seeding potentialities.**—*Author's abstract.*

**11M–869** 551.509.617:551.574.2:546.57:546.15

Facy, L. (*Météorologie Nationale, Paris*), **L'efficacité glaçogène des noyaux d'iodure d'argent.** [Freezing effectiveness of silver iodide nuclei.] *Geofisica Pura e Applicata*, Milan, 40:227–234, **1958.** 12 refs. French and English summaries p. 227. **DWB**—The author first recalls the ideal physicochemical properties for ice forming nuclei, and with particular reference to silver iodide he observes that, despite its very weak solubility, there is a critical dimension of the nuclei below which they are ineffectual, owing to the fact that they dissolve when introduced into clouds at positive or weakly negative temperatures. As a result, contrary to the techniques used up till now, it is not advisable to try to obtain dispersion with a high output, since the number of nuclei measured in the laboratory or in the cold chamber, does not represent the effectiveness of the nuclei introduced, for instance, from the ground into a cloud of positive temperature. For seeding techniques, a dimensional optimum should be respected, taking into consideration both solubility and the photochemical, or purely chemical de-activation. (*Same item as* 10.7–180, July 1959, *Met. Abs.*) *Subject Headings:* **1. Freezing nuclei 2. Cloud seeding with silver iodide 3. Cloud seeding techniques 4. Silver iodide properties.**—*Author's summary.*

**11M–870** 551.509.616:551.574.11

Facy, L. (*Météorologie Nationale, Paris*), **Les processus de congélation en atmosphère libre par capture des noyaux glaçogènes.** [Processes of freezing in the free atmosphere by the capture of freezing nuclei.] *Geofisica Pura e Applicata*, Milan, 40:217–226, **1958.** 4 figs., 2 refs. French and English summaries p. 217. **DWB**—The author first sets out the reasons why, in most cases, "freezing nuclei," properly speaking, do not first play the part of "condensation nuclei." He then describes a mechanism due chiefly to the processes of molecular kinetics in which molecular diffusion alone occurs during the transfer caused by the phase changes. Effectiveness and importance of that mechanism are sufficient to explain the majority of the phenomena observed in cloud physics, particularly with techniques of artificial seeding used for producing precipitation or for antihail experiment purposes. (*Same item as* 10.7–179, July 1959, *Met. Abs.*) *Subject Headings:* **1. Freezing nuclei 2. Cloud seeding.**—*Author's summary.*

**11M–871** 551.509.617:551.578.7

Fea, G.; Rosini, E. and Vittori, O., **A proposito di ossidi ionizzanti e radioattivi.** [Ionizing and radioactive oxides.] *Rivista di Meteorologia Aeronautica*, Rome, 18(1):51, **1958. DLC**—Suggested use of ionizing or radioactive oxides for inducing rain or preventing hail does not have official sanction of the Meteorological Service. *Subject Headings:* **1. Cloud seeding with radioactive oxides 2. Hail prevention 3. Radioactive oxide hail suppression.**—*M.R.*

**11M–872** 551.509.612:551.584

†Fournier d'Albe, E. M., **The modification of microclimates.** *UNESCO Arid Zone Research*, No. 10:126–146, **1958.** table, 138 refs. **DWB, DLC**—Microclimate is defined as the aggregate of the physical properties of the atmospheric environment of plants and animals, and the influence exerted upon the atmospheric environment by the intensity and spectral distribution of solar radiation, air movement, air and soil temperature, humidity of the air, and water supply by rainfall and underground water. The changes in microclimate produced by the natural growth of vegetation are examined with respect to changes induced in the radiation balance as a result of changes in level of absorption of radiation in albedo, etc. Air movement, air and soil temperature, transpiration, and water supply are extensively discussed, and the indirect influence of animals upon microclimate by their effect upon vegetation is considered. The various artificial means to modify microclimates, such as the use of windbreaks, shelter belts, frames and greenhouses to modify air movement; the day and night modification of radiation and thermal balance; modification of water balance by irrigation, cloud seeding, infiltration and runoff and the estimation of the water requirements are discussed. (*Same item as* 10.7–175, July 1959, *Met. Abs.*) *Subject Headings:* **1. Microclimatic amelioration 2. Microclimatic influences.**—*I.L.D.*

**11M–873** 551.509.616l(46)

Franco, Pedro R., **Experimentos de inseminacion de nubes en la cuenca del Duero.** [Cloud seeding experiments in the Duero Valley.] (In: Italy. Simposio Internazionale sulla Fisica delle Nubi e Relative Applicazioni all'Agricoltura, Asti, Italy, April 1958, **Atti,** pub. Dec. **1958.** p. 122–123. Spanish and Italian summaries p. 123.)—Report of the experiments in cloud seeding by means of AgI and NaI in the Duero Valley (Spain), carried out by the Spanish Meteorological Service. (*Same item as* 11.4–217, April 1960, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding experiments 2. Duero Valley, Spain.**—*Transl. of author's abstract.*

**11M–874** 551.509.617:551.578.7(44)

Genève, R., **Le contrôle de la lutte contre la grele.** [Evaluation of hail protection.] *Puy de Dôme, Observatoire, Bulletin,* No. 2:57–62, April/June **1958.** 4 figs., 2 refs. French and English summaries p. 57. **DWB**—The large-scale seeding experiments carried out in the S.W. of France have been replaced by a control using current meteorological observations. The study of hail probability during a thunderstorm, of the hailstone's diameter, and the duration of the fall does not show a significant effect of these operations. (*Same item as* 10.11–212, Nov. 1959, *Met. Abs.*) *Subject Headings:* **1. Physics of condensation 2. Hail protection 3. Hail probability during thunderstorms 4. France.**—*Author's abstract.*

**11M–875** 551.578.7:551.509.54(047.4)(447)

Genève, R., **Contrôle d'opérations de lutte contre la grêle.** [Evaluation of hail control operations.] *France. Météorologie Nationale, Rapport Technique* [Unnumbered], **1958.** 15 p. 12 figs., 5 refs. Mimeo.—Study of a method of evaluating hail prevention experiments conducted in S.W. France, where seedings through iodide diffusion operated from the ground, are done on a large scale. This method is based on observations of the synoptic network and on information from the thunderstorm and hail reporting station network. The hail generation factor (R) is represented by the ratio of the number of hail observations to the number of thunderstorms observed either with or without hail, for a determined period and area. The relationship between hail frequency and the intensity of the rain associated with it is examined. Frequency increases rapidly with rain intensity. Ratio remains between 6 and 9% and no clear-cut change appears since 1951 (start of seedings), and no relation is evident between the change of R and that of the number of silver iodide generators used. Hailstone size frequency distributions are shown for the months May to Sept. for the periods 1947–1950 and 1951–1957. Influence of seeding cannot by discovered. In the second part, author tries to link surface distribution of hail during a day with that of indexes computed from meteorological measurements (instability). In general, hail is reported in the vicinity of steep temperature gradients, provided that dew-point temperatures are comparable. (*Same item as* 10M–336, *Met. Abs.*) *Subject Headings:* **1. Hail prevention 2. Cloud seeding with silver iodide 3. Hailstorm frequencies 4. Hailstone size distribution 5. Southwestern France.**—*A.V.*

**11M–876** 551.524.371:347.98 551.509.617:551.578.7:347.985

Geslin, H., **La lutte contre la grêle et la gelée.** [Action against hail and frost.] *Phytoma,* Paris, 10(102):32–36, Nov. **1958. CU, DA**—Short account of the methods of action against hail and frost and examination of this question from the legal point of view in France. The author considers that this problem of action against hail is still at its very beginning and that one must adopt an extremely prudent attitude before adopting a general method of action. *Subject Headings:* **1. Hail prevention 2. Frost protection 3. Legal aspects of weather modification.**—*A.V.*

**11M–877** 551.509.617:551.578.7(494.5)

Hohl, P., **Hagelbekämpfung im Tessin.** [Hail control in Ticino.] *Die Grüne*, Zurich, 86(32): 939–941, Aug. 8, **1958.** fig. **DA** (17 Sch9)—Some statements of the report of the third large-scale experiment of hail control in Ticino in 1957 are quoted (for abstract of the report *see* 11M 897). "Accidental" organization of experimental days free from human influence is explained. Hail control by silver iodide seeding or decrease of lightning was not observed. The continuation of experiments is suggested. *Subject Headings:* **1. Hail prevention 2. Ticino, Switzerland.**—*O.T.*

**11M–878** 551.509.617 551.515.21(729.1)

Howell, Wallace E., Associates, Inc., Cambridge, Mass., **Evaluation of cloud seeding for the cane areas of Centrales Francisco and Elia Province of Camaguey, Cuba, September 1958 May 1959.** 9 p. 2 figs., table. **DWB** (M09.67 H859ev)—A report on the rainfall stimulation activities in the Province of Camaguey, Cuba, is given. The study includes tabulated details of the evaluation of the activities of Hurricane "Helen" during 1958 in the areas of Elia, Francisco and discussion of the possibility of changing the evaluation techniques now in use. (*Same item as* 12.1–267, Jan. 1961, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding evaluation 2. Hurricane "Helen" (1958) 3. Camaguey Province, Cuba.**—*N.N.*

**11M–879** 551.509.617(747)

Howell, Wallace E. (*W. E. Howell Associates, Inc.*), **A reappraisal of an early cloud seeding evaluation.** *Journal of Meteorology*, Boston, 15(6):562–563, Dec. **1958.** fig., 3 tables, 5 refs. **DWB, DLC**—Cloud seeding data of 1951 and 1952 obtained during seeding operations in northwestern New York State and evaluated by comparing runoff from the seeded watersheds with that from nearby control watersheds for the seeded seasons and the fourteen preceding seasons yielded an indication of a 32% increase in runoff with a probability of chance occurrence less than 0.0005. The evaluation is reappraised by testing the runoffs of subsequent unseeded seasons according to the same criteria used for the seeded seasons. Statistical analysis of the first and second seeding seasons indicated an encouraging but not significant increase for former and a statistically significant increase for the latter. An analysis for four subsequent unseeded seasons (1953–1956) showed that the departures accumulated during the seasons without seeding were what would have been expected by chance and the number of positive departures equaled the number of negative ones. None of the four seasons showed an accumulation of departures comparable in size to the positive departures that occurred during the 1952 seeding season. The hypothesis that cloud seeding increased significantly in 1952 runoff is strengthened. *Subject Headings:* **1. Cloud seeding evaluation 2. New York State.** —*I.L.D.*

**11M–880** 551.509.615

†Junge, Christian E., **Methods of artificial fog dispersal and their evaluation.** *U. S. Air Force. Cambridge Research Center, Air Force Surveys in Geophysics*, No. 105, Sept. **1958.** 19 p. 2 tables, 25 refs. **DWB, DLC**—In this Survey an attempt was made to include all fog dispersal methods and suggestions whether tested or not. Some may have been overlooked; but the list is considered fairly complete, falling in classes of dispersal by heating, desiccation, mechanical means, and electrical means. Only the principal ideas and basic facts are given, and in those cases of impracticability, the reasons for being impractical are included. Experimental results and field tests are carefully listed; and essential facts and considerations are summarized, including conclusive remarks about the methods' applicational possibilities. For the time being, the improved and mobile heating methods appear superior and all efforts should be made to improve them. Although chemical and electrical methods appear to be fairly impractical and not very promising, more systematic research is needed to draw final conclusions. (*Same item as* 10.9–161, Sept. 1959, *Met. Abs.*) *Subject Heading:* **1. Artificial fog dissipation.**—*Author's abstract.*

**11M–881** 551.509.617

Krick, Irving P. (*Water Resources Developm. Corp., Denver, Colo.*), **The theory and practice of weather modification.** *Texas A. and M. College, College Station, Proceedings of the 3rd Annual Conference on Water for Texas, Sept.* 1957, (issued **1958?**). p. 60–74. 15 figs. (incl. photos), 8 refs. **DWB** (M79 C748pro), **DLC** (TD201.T37)—Various things have to be considered in connection with weather modification. This report includes such items as: precipitation mechanisms, silver iodide nucleation, silver iodide generator, and operational control, as being extremely important. Tables, charts, pictures and graphs are included. *Subject Heading:* **1. Cloud seeding.**—*N.N.*

**11M–882** 551.578.7:551.574.1

*†Ludlam, F. H. (*Imperial College, London*), **The hail problem.** *Nubila*, Verona, Italy, 1(1):12–96, **1958.** 12 figs., 18 tables, 55 refs., 72 eqs. **DWB**—This major monographic paper summarizes

recent advances in most of the aspects of the hail problem: necessity for cumulus convection, theor of thermals, actual thermals, internal structure of cumulus, aerosol particles, formation of cumul cloud particles, size spectrum of drops in Cu, formation of fall out in Cu, growth of hailstones (dr and wet), density of hailstones in different stages, use of growth equations, melting of large hailstone maximum size of hailstones, forecasting the maximum size of hailstones, evaluation of the storm clou and prevention of hailstorms. Many graphs and diagrams representing both theoretical and em pirical models are included, and sources are well documented. It is considered that hailstorms ma be suppressed by heavy seeding with AgI or with hygroscopic salts. (*Same item as* 10.2–28, Feb 1959, *Met. Abs.*) *Subject Headings:* **1. Hail physics 2. Cloud physics 3. Hail prevention.**—*M.K*

**11M–883** 551.509.616:551.576.11:551.594.2:551.574.1

MacCready, Paul B., Jr. (*Res. Associate, The Munitalp Foundation, Inc.*), **The lightning mech anism and its relation to natural and artificial freezing nuclei.** *Conference on Atmospheric Electricity 2nd, Portsmouth, N. H., May* 1958, *Proceedings*, issued **1958.** p. 369–381. 11 figs., table, 9 refs., eqs **DWB** (M(055) C748pr)—Observations during cloud physics field projects in Montana, Florida an California have been consistent with the view that strong electrification of convective clouds is result of the fall of hail or graupel through a supercooled cloud. This type of electrification can b related quantitatively in a simple hydrometeor-growth model to the freezing nuclei concentration the upcurrent strength, the cloud base temperature and the cloud depth. Clouds with bases at th freezing level were investigated. For such clouds it was found that there were three distinct hy drometeor-growth regimes: "Complete overseeding" when so many nuclei are present that glaciatio prevents any of the hydrometeors from growing large enough to fall through the upcurrent. "Showe precipitation" when hydrometeors fall down through the cloud base, but deplete the water in th cloud enough to inhibit subsequent hydrometeor-growth. "Equilibrium precipitation" when ther are so few nuclei that the hydrometeors do not materially reduce the liquid water content of the cloud The results indicate that silver iodide seeding can strongly decrease the electrification of a cloud onl for "complete overseeding." For moderate upcurrents this requires somewhat greater nucle concentrations can only produce a marked decrease of electrification by some secondary effect o cloud dynamics beyond the scope of this study. The study also shows that (a) when the clouds ar cold enough for natural nuclei to cause precipitation, silver iodide will speed the precipitation proces but not add substantially to the total amount, (b) over broad limits the concentration of silver iodid is not critical for precipitation, and (c) a decrease of damaging hail is well within the range of con ventional silver iodide seeding. (*Same item as* 11.2–156, Feb. 1960, *Met. Abs.*) *Subject Headings* **1. Electrification of convective clouds 2. Cloud seeding effects 3. Overseeding with silver iodid 4. Nuclei effects on electrification.**—*Author's abstract.*

**11M–884** 551.509.616:551.574.1:551.576.1

†McDonald, James E. (*Inst. of Atmospheric Physics, Univ. of Arizona, Tucson*), **The physics o cloud modification.** *Advances in Geophysics*, N. Y., Vol. 5:223–303, **1958.** 5 figs., 9 tables, 107 refs **DWB, DLC**—A long and systematic review of recent literature on: clouds and water vapor cycle in atmosphere, present status of cloud physics (condensation and precipitation processes), cloud modification techniques and the evaluation of cloud modification experiments. Coalescence proc esses are stressed. Dry ice, silver iodide, water spray and giant salt nuclei are considered the main current techniques to be investigated, but future advances more spectacular than tentative pas successes may come from pure research along lines not yet explored. (*Same item as* 10.9–140, Sept 1959, *Met. Abs.*) *Subject Headings:* **1. Artificial cloud modification 2. Cloud physics research 3. Progress in cloud seeding.**—*M.R.*

**11M–885** 551.509.617(691)

Madagascar. Service Météorologique, **Les opérations de pluie provoquée à Madagascar en 1957.** [Artificial rain produced at Madagascar during 1957.] *Bulletin de Madagascar*, Madagascar No. 141:107–110, Feb. **1958.** 2 figs.—In the authors' opinion, significant results were repeatedly obtained during the months Jan., Feb., and April in different regions of Madagascar. On the other hand, the trials made during the cool season were less conclusive. A new analysis method has been elaborated and is based on the comparison of the pluviometry in the treated zone and in a zone double in area encircling the first mentioned zone. For the authors, the efficacy of seedings seems to be confirmed. (*Same item as* 10.5–194, May 1959, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding in Madagascar 2. Madagascar.**—*A.V.*

**11M–886** 551.509.617(433)

Müller, Hans G., **Les travaux préparatoires pour les expériences antigrêle en Bavière.** [Pre liminary work for hail control experiments in Bavaria.] (In: Simposio Internazionale sulla Fisica delle Nubi e Relative Applicazioni all'Agricoltura, Asti, Italy, April 1958, **Atti**, issued Dec. **1958**

p. 95–110. 11 figs., table, 5 refs. *French, Italian and English summaries* p. 110.)—Proposal of hail control experiments in the county of Rosenheim permitting to compare regions of the same nature with those without hail control activity. *Subject Headings:* **1. Hail prevention in Bavaria 2. Rosenheim, Germany.**—*Author's abstract.*

**11M–887** 551.509.617:551.579

Orville, Howard T. (*Beckman & Whitley, Inc., San Carlos, Calif.*), **The effects of weather modification on water supplies.** (**1958.**) 16 p. table, 24 refs. Reproduced from typescript. Prepared for AAAS, Section O-Agriculture, Washington, D. C., December 29–30, 1958.—The theory of weather modification, possible effects on water supply, existing weather modification operations and the extent of interest in such operations are discussed. *Subject Heading:* **1. Cloud seeding effects on water supply.**—*N.N.*

**11M–888** 551.509.617:546.815

†Papée, Henry M. (*Natl. Research Council, Canada*), **On the preparation and sintering of cloud precipitation agents: lead di-iodide microcrystals.** *Canadian Journal of Chemistry*, Ottawa, 36:1443–1448, **1958.** 4 figs., 25 refs. **DLC**—Two experimental processes of sintering lead iodide of relatively large and controlled specific surface areas have been described. These processes are in connection with a microcalorimetric study of heat of adsorption of water vapor on lead iodide surfaces. The report gives the analysis as well as the results of this investigation on water condensation. (*Same item as* 11.9–233, Sept. 1960, *Met. Abs.*) *Subject Heading:* **1. Cloud seeding with lead di-iodide.** —*N.N.*

**11M–889** 551.509.617(529)

*Rain Stimulation Research Institute, Taipei, Taiwan, China, **Third report on cloud-seeding experiments over Sun-Moon Lake area, 1954–1956.** Issued August **1958.** 11 p. 2 figs., 11 tables. **DWB**—This is the third in a series of reports concerning cloud seeding experiments in Taiwan initiated in 1951 (for 2nd report *see* 11M–729). The period covered in this report is the dry seasons during 1954–55 and 1955–56. The times of operation, the weather summary, and the evaluation of the 1954–56 seeding activities are presented. It is concluded that during the five dry seasons 1951-52 to 1955-56, the average increase in rainfall over the target area is 23% and the probability of this increase having resulted from the seeding activities is 77%. (*Same item as* 12.2–256, Feb. 1961, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding experiments 2. Taiwan, China.**—*I.S.*

**11M–890** 551.509.615:551.575.1

Ramsey, M. A. (*Engineer, Worthington Corp.*), **Eliminating man-made fog.** *Air Conditioning, Heating and Ventilating*, N. Y., 55(12):55–58, Dec. **1958. DWB, DLC**—Definite solution for eliminating or preventing fogs arising from human activities is demonstrated here by means of simple psychrometric charts. Since the locus of any possible air-water mixture approximates the straight line between two points representing the condition of the mixtures on the chart, this mixture line, if within the area of the saturation curve, below 100 rh will indicate no fog, if to the left of the saturation curve for any part, the point on the locus in that region results in fog, and the thicker the farther out from the saturation curve. The illustrated examples are applicable but not restricted to swimming pools, shower rooms, industrial areas, skating rinks, cooling towers, evaporative condensers, etc. (*Same item as* 12.2–248, Feb. 1961, *Met. Abs.*) *Subject Heading:* **1. Fog prevention.**—*W.N.*

**11M–891** 551.574.1:536.421

Sano, I.; Fujitani, Y. and Kawase, K., **An experiment on the supercooling of water-droplets containing foreign solid particles.** *Meteorological Society of Japan, Tokyo, Journal*, 36(3):112 117, June **1958.** 9 figs., table, 23 refs. **DWB, DLC**—A number of water droplets, uniform in size at 1.0, 0.6, 0.3 or 0.2 mm diameter, were prepared from water holding powder suspended as well as water having no addition, by electrical atomization, on a paraffin-covered glass-plate. This glass-plate was placed horizontally in a flat case tightly made of two brass plates with a rubber frame between, and was cooled at various temperatures down to −30°C in a cryostat. Following this, the plate was quickly taken out from the case, and the droplets which had frozen were counted without delay in a low temperature chamber, using a phase contrast microscope and, on occasions, by the naked eye. The powder materials suspended were iodides of silver, mercury and lead, and further, oxides of copper, cadmium and zinc. Lead iodide was the most soluble of the materials examined, so that an investigation into the influence of aging of the powder in suspended state upon the supercooling phenomenon was carried out in the following manner: the suspension of lead iodide was, after its production, allowed to stand in a closed vessel with frequent stirring for the periods of 0, 2 and 8 days at 5°C or thereabouts, and these three samplings dispersed each to droplets by the same method as with the other materials. The results are roughly as follows: 1) The smaller the droplets, the more likely they are to exhibit supercooling, the finding being the same in both the absence and

presence of solid particles in water, and there appears to exist a linear relation between the logarithm of droplet-diameter and the freezing temperature. 2) Of the materials tested, silver iodide is most effective in solidifying water under supercooled condition, and its effectiveness goes up, though slightly, as the amount added to water is increased; lead iodide deteriorates considerably on account of its solubility. 3) The equation $\ln\{x/(100-x)\}=k\cdot(\theta-\theta')$ is presented as giving the fraction ($x$ %) of droplets frozen at a supercooling ($\theta$°C, expressed in terms of the lowering from 0°C), $k$ being a constant depending on the conditions of experiment such as the droplet size, the nature and amount of the powder suspended, etc. and $\theta'$ the supercooling at which $x=50$. *Subject Headings:* **1. Supercooled water drops 2. Silver iodide nucleating process.**—*Author's abstract.*

**11M–892** 551.509.615:551.574.

Seregin, Iu. A., **Rasseianie pereokhlazhdennykh tumanov s zemli aerozolem iodistogo serebra** [Dissipation of supercooled fog from the ground with silver iodide aerosols.] *Moscow. Tsentral'nai Aerologicheskaia Observatoriia, Trudy*, No. 19:68–80, **1958.** 4 figs., 2 tables, 6 refs. **DWB**—The first part of the article is devoted to the methods used in the experiments. The construction of generators for the production of silver iodide aerosol, the methods of preparation of the solution the work of the generator, and the meteorological observations are described briefly. The second part of the article contains detailed descriptions of the results. Tabulated data are analyzed and the conclusion is drawn that there exists a possibility of dissipating fog from the ground, which is of great significance to aviation. *Subject Headings:* **1. Artificial fog dissipation 2. Silver iodide fog dissipation 3. Supercooled fog.**—*B.J.G.*

**11M–893** 551.509.617 551.509:061.1(47

Shtal', V. A., and Morachevskiĭ, V. G., **Aktivnoe vozdeĭstvie na pogodu.** [A method for acting upon the weather.] *Priroda*, Moscow, No. 9:85–88, Sept. **1958.** 5 figs. **DLC**—An Institute for Artificial Rain was established in the U.S.S.R. in 1931 in the People's Commissariat for Agriculture. Subsequently it was transferred to the Leningrad Institute of Experimental Meteorology. The problem of weather modification is being investigated also by the Principal Geophysical Observatory, the Central Aerological Observatory, etc. In 1949 B. Ia. Nikandrov produced artificial rain in 11 out of 15 attempts with cumulus and strato-cumulus clouds. The mode of action of dry ice and AgI seeding of clouds, results of experiments carried out in Japan and Madagascar and the opinions of American meteorologists on the effectiveness of cloud seeding are summarized. The seeding of low clouds and fog to improve visibility over airports by means of dry ice, AgI, etc. from airplane and the process of cloud or fog dispersion are described with the aid of photographs. Dry ice proved effective at an air temperature of −5°C and wind velocity not exceeding 8–10 m/sec. At larger wind speeds only holes were formed in the clouds and a stable zone of clearing was not produced. The use of cloud shooting in hail prevention and the dissipation of thunderstorm clouds to prevent thunderstorms are discussed. (*Same item as* 12.2–257, Feb. 1961, *Met. Abs.*) *Subject Headings:* **1. Progress in weather control 2. Artificial cloud modification.**—*I.L.D.*

**11M–894** 551.574.1:551.509.6:061.

Simposio Internazionale sulla Fisica delle Nubi e Relative Applicazioni all'Agricoltura, Asti, Italy, April 27–28, 1958, **Atti.** [Proceedings of the International Symposium on Cloud Physics and the Applications to Agriculture.] Issued Asti, Centro per lo Sviluppo della Difesa Antigrandine della Provincia di Asti, Dec. **1958.** 143 p. figs., tables, refs. Review by H. Dessens, in *Puy-de-Dôme. Observatoire Bulletin*, No. 2:63–70, April/June, **1958.** Also review in *Geofisica e Meteorologia* Genoa, 6(1/2):20, April **1958. DWB.** The Symposium was attended by experts from most of the European countries. Among the principal subjects treated were: cloud seeding, icing nuclei, hail prevention, dynamics of thunderstorm clouds and cold air invasions. (For papers dealing with weather modification *see* 11M–866, –873 and –886.) (*Same item as* 11.6 24, June 1960, *Met. Abs.*) *Subject Headings:* **1. Cloud physics conferences 2. Hail prevention. I. Dessens, H.**—*A.V.*

**11M–895** 551.509.616:551.574.2:629.13

Smith, E. J.; Heffernan, K. J. and Thompson, W. J. (*all, Div. of Radiophysics, Commonwealth Scientific & Indust. Res. Organiz., Sydney, Australia*), **The decay of the ice-nucleating properties of silver iodide released from an aircraft.** *Royal Meteorological Society, Quarterly Journal*, 84(360) 162–165, April **1958.** 2 figs., 2 tables, 6 refs. **DWB, DLC**—Silver-iodide smoke was released from an aircraft, together with a tracer of zinc sulfide, and both aerosols were detected in another aircraft. About $2\times10^{14}$ freezing nuclei were emitted per gram of silver iodide burnt. The number of effective nuclei decreased on exposure to the air in the daytime by a factor of 1000 in two hours. At night there was no detectable decay. (*Same item as* 10.1–183, Jan. 1959, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding from airplane 2. Silver iodide decay 3. Silver iodide from aircraft.**—*Author's abstract.*

11M–896 551.509.617:546.57:546.15

Smith, N. M., **Cloud seeding at Bundaberg.** *Cane Growers' Quarterly Bulletin*, Brisbane, 21(3):84–87, Jan. 1, **1958.** 3 figs. **DA** (65.9 Q3C)—The effects of cloud seeding by aircraft in the drought of 1957 are described. Operations were conducted under unfortunate conditions but indicate the probability of later success. A sketch shows silver iodide seeding. *Subject Headings:* **1. Cloud seeding effects 2. Cloud seeding with silver iodide.**—*O.T.*

11M–897 551.509.617(494):551.578.7

*Switzerland. Eidg. Kommission zum Studium der Hagelbildung und Hagelabwehr, **Grossversuch III zur Bekämpfung des Hagels im Tessin, 1. Versuchsjahr.** [Project 3 for hail control in Ticino, 1st year of experiment.] Its *Tätigkeitsbericht*, No. 10, 1957, pub. **1958.** 11 p. maps, numerous tables. **DWB**—As in previous years (for reports covering the 1953–1956 seasons *see* 11M-657, –749 and –830), hail prevention experiments were continued by means of ground-operated silver iodide generators. The area of coverage was extended to include not only the Magadino Plain as heretofore, but the entire Tessin south of the Bellinzona-Cardada-Gridone line. The number of generators used was increased to 20. Another change was the conducting of operations according to a statistical evaluation scheme developed (and discussed in this report) by P. Schmid. Results of the operations are described and illustrated in the same detailed manner as in previous reports. Due to the paucity of data, no definite conclusions can be drawn either of a positive or negative effect, or of no effect of AgI seeding upon hail formation, but a definite positive correlation appears to exist between AgI seeding and precipitation intensity (the ratio of precipitation amounts per unit time on unseeded and seeded days was 1/2). Thus it can be safely assumed that AgI smoke reaches effective levels under orographic conditions. Experiments are expected to be continued for several years before their final statistical evaluation can be undertaken (for later reports *see* 11M–960 and –1011). (*Same item as* 10.7–32, July 1959, *Met. Abs.*) *Subject Headings:* **1. Hail prevention in Switzerland 2. Cloud seeding with silver iodide 3. Ticino, Switzerland. I. Sänger, R. II. Thams, J. C. III. Schmid, P.**—*G.T.*

11M–898 551.506.1:551.509.6

*Texas. Univ. Bureau of Engineering Research, **(First) Annual report on the study of weather modification.** Issued Aug. 31, **1957.** 74 p. 23 refs. Mimeog. Also **Second annual report,** issued Aug. 31, **1958.** 65 p. 18 figs., 2 tables, 9 refs. **DWB** (M09.67 T356an)—The First Annual report itemizes the progress made during the first eleven months of the "Study of Weather Modification," a research project supported by the Board of Regents of the University of Texas and by Houston Endowment, Inc., Houston, Texas. Principles of cloud and precipitation physics are outlined. Statistical and graphical analyses of the physical climates of Texas, the foundation upon which future experiments in cloud modification in this state must be based, are enumerated. Several experimental climatic investigations are described. The climatological data file acquired for the Study is described. Figures are shown of the 1921–1950 and 1927–1956 normal distributions of precipitation and temperature over Texas as well as of precipitation expectancy during the drought period of 1946–1956.—**The Second Annual Report** summarizes activities during the fiscal year 1 September 1957 through 31 August 1958. Included are discussions of short-term trends in climatic fluctuations and their effects on the stability of climatological normals, especially with regard to the State of Texas; a description of the traditional climatographical analyses applied to up-to-date statistics of temperature and precipitation from the complete Texas reporting network; and an account of the preliminary work done on contract with the Department of Health of the State of Texas in an investigation of the influences of climatological factors on the incidence in Texas of endemic dental fluorosis. Appendices show the difference in the trends of 40-year averages of precipitation and temperature at 25 representative Texas stations. *Subject Headings:* **1. Progress in weather control 2. Annual meteorological reports. I. Moyer, Vance E. II. Cry, George W.**—*Authors' abstract.*

11M–899 551.509.617:551.574.2:551.576.1

Twomey, S. (*Radiophysics Laboratory, Sydney, Australia*), **Quantitative aspects of seeding rates for use in supercooled clouds.** *Puy de Dôme, Observatoire, Bulletin*, Ser. 2, No. 2:33–42, April/June **1958.** 2 figs., 2 tables, 3 refs. French and English summaries p. 33/34. **DWB**—The use of materials such as silver iodide for initiating precipitation in supercooled clouds is based on the Bergeron-Findeisen process of rain formation. As this process requires the co-existence of ice and liquid water in the cloud, any reduction of the volume of cloud within which the two phases co-exist is clearly undesirable. It is shown that seeding with silver iodide can in certain conditions have this result. Computations of the minimum and maximum rates of seeding are made for various values of updraught and cloud top temperature. *Subject Headings:* **1. Condensation physics 2. Supercooled clouds 3. Updraught.**—*Author's abstract.*

**11M–900** 551.509.616:551.59

Uchida, E. (*Met. Res. Inst., Tokyo*), **On the beginning times of thunders in the cloud seedi experiments.** *Papers in Meteorology and Geophysics*, Tokyo, 8(4):282–291, Jan. **1958.** 4 fig 3 tables, 12 refs., 2 eqs. **DWB**—It was found (during August 1952 cloud seeding tests in the Kan and Chubu Districts of Japan) that thunder was apt to break out in succession towards the leewa along the path of the drifting silver iodide smoke in cloud seeding experiments and some explanati for it was attempted in the light of recent knowledge of thunderstorms (1951–1956 data). T height and temperature of the level at which the top of the smoke reached cumulonimbus clou and the process of the outbreak of thunder after the arrival of the smoke in the clouds were discusse (*Same item as* 11.1–179, Jan. 1960, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding effects 2. Thu der during cloud seeding.**—*Author's abstract.*

**11M–901** 551.509.61:061

†U. S. Congress. House. Committee on Interstate and Foreign Commerce, **Weather modific tion research. Hearings before a subcommittee of the Committee on Interstate and Foreign Co merce, House of Representatives, 85th Congress, 2nd Session, on S.86, an act to provide for research program . . . March 18 and 19, 1958.** Washington, D. C., U. S. Govt. Print. Off., 195 107 p. Bibliography on weather modification, p. 98–107. **DWB** (M09.67 U583we)—The prese status of weather modification is depicted in considerable detail in statements, papers and replies questioning by such witnesses as F. W. REICHELDERFER (U. S. Weather Bureau), HOWARD T. ORVIL (formerly Advisory Commission on Weather Control), B. VONNEGUT, (scientist), B. QUATE, J. DISANTO (commercial cloud seeders), and others. (*Same item as* 12.2–251, Feb. 1961, *Met. Ab Subject Headings:* **1. Congressional hearings on weather control 2. Weather modification researc 3. Weather modification bibliographies.**—*G.T.*

**11M–902** 551.509.616:546.

van Straten, F. W. (*Office of the Chief of Naval Operations*); Ruskin, R. E. and Dinger, J. E. (*bo U. S. Naval Res. Lab.*), **Demonstration supporting a new hypothesis for cloud modification.** *Weath Radar Conference, 7th, Miami Beach, Florida, Nov.* 17–20, 1958, *Proceedings*, issued **1958.** Se A:48–57. 3 figs., table, 7 refs. **DWB** (M01.81 R124pc, 1958)—A hypothesis based on speculatio concerning the origin of tropical rain led to a technique for modifying the heat balance in limit portions of the atmosphere. This change in heat distribution should permit some degree of clo modification. Initial demonstration of the technique consisted of successful attempts to dissipa seven cumulus congestus clouds by introducing small amounts of carbon black near their tops a to generate five clouds in clear air by "carboning" in a humid layer of the atmosphere. *Subj Headings:* **1. Cloud modification experiments 2. Carbon black 3. Cloud seeding with carbon blac** —*Authors' abstract.*

**11M–903** 551.509.616(546.2

van Straten, F. W.; Ruskin, R. E.; Dinger, J. E. and Mastenbrook, H. J., **Preliminary expe ments using carbon black for cloud modification and formation.** *U. S. Naval Research Lab., N Report*, 5235, Oct. 28, **1958.** 17 p. 11 figs. (mostly photos, some fold.), table, 7 refs. **DW** (M(055) U586r)—Speculations concerning the origin of tropical rain led to a hypothesis for a meth of cloud modification or formation based on artificially changing the heat distribution in limited par of the cloud or atmosphere. Flight experiments were carried out in which small amounts of carb black were dispensed into warm cumulus clouds. These experiments were based on the assumptio that the absorption of solar radiation by the carbon black would alter the heat distribution in t cloud. Seven clouds were thus "carboned," and on the basis of observations by trained meteo ologists, pilots, and the subsequent analysis of photographs, convincing evidence is presented th each cloud dissipated as a consequence of treating it with $1\frac{1}{2}$ to 6 pounds of carbon black. Clou were caused to form in clear humid air by dispensing carbon black at the approximate altitude existing cumulus cloud bases in nearby areas, presumably by initiating thermal updrafts due to t solar heating, thus raising the moisture to an altitude where condensation starts. *Subject Headin* **1. Cloud seeding with carbon black.**—*Author's abstract.*

**11M–904** 551.509.616:551.594.

Vonnegut, Bernard and Moore, Charles B., **Preliminary attempts to influence convecti electrification in cumulus clouds by the introduction of space charge into the lower atmospher** Arthur D. Little, Inc., Contract Nonr-1684(00), [Unnumbered report], **1958.** 24 p. 10 figs 13 refs. **DWB** (M94 V947pr)—If electrification of cumulus clouds is initiated by the fair-weath space charge in the air from which they develop, it should be possible to influence their electrificatio by introducing sufficient amounts of electric charge into the lower atmosphere. In preliminar experiments carried out during the spring and summer of 1957 at Jacksboro, Tex., approximate one milliampere of negative electricity was released from a wire 7 km long and 10 m above the groun

The resultant negative space charge was sufficient to reverse the fair-weather electric field for about 8 km downwind. An electric field meter 7 km downwind showed that when low level cumuli growing from the charged air passed overhead, the field became more strongly anti-fair-weather. These observations indicate that the negative space charge was carried by updrafts into the cloud. Because of lack of adequate instrumentation, we could not determine the effect of the charged air on the subsequent electrical development in the cloud. (*Same item as* 10.6–160, June 1959, *Met. Abs.*) *Subject Headings:* **1. Electrification of convective clouds 2. Cloud modification experiments.**—*Authors' abstract.*

**11M–905** 551.509.61

Wexler, Harry (*Dir. Met. Research, U. S. W. B.*), **Modifying weather on a large scale.** *Science*, Wash., D. C., 128(3331):1059–1063, Oct. 31, **1958.** 3 figs., 2 tables, 19 refs. **DLC**—Modification of climate and weather on a great scale, subject to change by artificial means of the two basic radiation curves—the downward and upward streams of radiant energy from the sun—is discussed. Proposals to change the albedo, reflectivity of deserts and snowfields by blackening them with carbon dust are examined, the extent of effective change assessed, and practical difficulties of logistics, etc. enumerated. The alternate possibility of reducing the return of infrared radiation to space by the formation of ice clouds is considered. Manufacture of the ice cloud, its effect on radiation balance and temperature, and meteorological consequences are discussed and graphically explained. It is emphasized that before entertaining any serious proposals for large scale weather modification, its meteorological consequences, apart from practical considerations, must be given though "so as to avoid the unhappy situation of the cure being worse than the ailment." (*Same item as* 11.9–235, Sept. 1960, *Met. Abs.*) *Subject Heading:* **1. Climate control.**—*I.S.*

**11M–906** 551.574.1:551.509.616/7(94)

**Australian research in cloud and rain physics.** *Pan Indian Ocean Science Congress, Aug.* 1954, *Perth, Western Australia, Proceedings of Section A, Physical Sciences*, (pub. **1958**?). p. 80–83. Also: **Cloud seeding in Australia.** *Ibid.* p. 84–85. 10 refs. **DWB** (506.35 P187pr)—In certain weather conditions Sydney has some suitable clouds for dry ice rainmaking. The agents that have been used in the experimental processes are the dry ice, silver iodide and water spray. A detailed summary of the recent investigations in the field of cloud and rain physics conducted in Australia is given. *Subject Headings:* **1. Cloud physics 2. Artificial precipitation 3. Australia.**—*N.N.*

**11M–907** 551.509.616:551.576.11(759)

**Clouds, carbon and change.** *Naval Aviation News*, Wash., D. C., Oct. **1958.** p. 20–23. photos. **DWB**—Illustrated account of tests made by FLORENCE W. VAN STRATEN (meteorologist of the Naval Weather Service) on July 29–31, 1958, over the Florida Coast, using carbon black to dissipate cumulus clouds (7 cases of "seeding" produced dissipation within 20 min). In other cases, clouds were created by this method. The principle is explained in terms of the creation of a temperature differential at the base of, or in, the cloud, or at the top of the cloud by using the high radiation absorption potential of carbon black. At high (60° to 65°F) cloud temperatures even a 1°F differential in droplet temperature creates a vapor pressure differential sufficient to cause drop accretion on the colder droplet. (*Same item as* 10.6–158, June 1959, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with carbon black 2. Carbon black 3. Florida Coast. I. Van Straten, Florence W.**—*M.R.*

**11M–908** 551.509.615:629.13:656.71

**Un procédé original de dissipation des brouillards au-dessus des pistes d'aérodromes.** [An original process of fog dispersal over airport runways.] *L'Air*, Paris, N°. 735:22–23, May **1958.** 4 figs. **DLC**—Statement of the basic ideas on which rests the technique concerning the precipitation of fogs through sound or ultrasound emissions. Results of experiments are described. The technique causing coalescence of clouds through seeding with hygroscopic particles is outlined. The author describes R. M. G. BOUCHER'S composite process which utilizes both methods. In this process one uses evaporators of nuclei and buzzers in alternation every 25 or 30 meters. Owing to this arrangement, the hygroscopic salts are at first set in motion by the thermal convection currents issued from the burners and converge afterwards in areas where the acoustical field is intense. The combination of the classical technique with the acoustical emissions should accelerate coalescence in significant proportions. *Subject Headings:* **1. Artificial fog dissipation 2. Coalescence.**—*A.V.*

**11M–909** 551.509.61:551.578.7:398.4(515)

**Quand les sorciers tibétains font la pluie et le beau temps et luttent contre la grêle.** [When Tibetan sorcerers make rain and fair weather and fight against hail.] **Phytoma,** Paris, 10(95):45–47, Feb. **1958.** 1 fig. **CU, DA**—The book by RENE DE NEBESKY-WOJKOWITZ studying the customs, habits, and beliefs of Tibetan people includes a chapter relating to practices used by sorcerers to provoke rainfall or to fight against hail. Public agencies and farmers employ and reward the

"weather makers." Working methods and processes used by the sorcerers to fight against ha lightning and drought are described. Leaving sorcery aside, it is however curious to see that o of the working methods used by these "weather makers" consists in sublimating salt on glowing coa (*Same item as* 10M–338, *Met. Abs.*) *Subject Headings:* **1. Hail prevention 2. Sorcery 3. Tib** —*A.V.*

**11M–910** 551.574.1(0

**Nubila,** Vol. 1, No. 1, **1958.** Quarterly. Issued Verona, Italy, by Unione Nazionale An grandine. Editor: Ovidio Romanelli. Current as per date of this notice. **DWB**—A substanti periodical regularly containing high-rate scientific articles on various aspects of cloud physics, and particular problems relating to hail and its prevention. (*Same item as* 10.3–36, March 1959, *M Abs.*) *Subject Headings:* **1. Cloud physics journals 2. Hail prevention 3. Serial publication I. Romanelli, O.** (*ed.*).—*G.T.*

## 1959

**11M–911** 551.509

Ackerman, Edward A. (*Carnegie Inst. of Washington*), **Weather modification and public polic** (In: Resources for the Future, Inc., **Science and resources for the future.** Baltimore, Johns Hopki Press, **1959.** p. 63–71.) **DLC** (Q171.R43)—A public policy and program on meteorology a weather modification is suggested. Two aspects to the program are seen. The first is the establis ment of two distinct programs; one to include cloud physics, weather formation and weather modific tion; the other to study the dynamics of the atmosphere on a planetary scale, and climate modificati from now speculative manipulation of the planetary circulation. The second aspect would be clear separation, in program, of fundamental and applied science. *Subject Heading:* **1. Weath modification programming.**—*E.S.*

**11M–912** 551.509.

Affronti, Filippo, **Bombe atomiche e condizioni meteorologiche nell' opinione pubblica di alcu paesi.** [Popular ideas in certain countries regarding atom bombs and their effect on meteorologic conditions.] *Rivista di Meteorologia Aeronautica,* Rome, 19(3):50–52, July/Sept. **1959.** fig., 2 re **DLC**—A German report (*Der Spiegel,* Hamburg) has published a graphic interpretation which sho the reply of people in many lands to the question: does the atomic bomb affect the weather? T public of Italy, 70.8% believed that it did; Germany 62%, France 59%, Japan 55%, England 35 gave an affirmative answer. Many thought typhoon Ida was an after effect of the atom bom *Subject Heading:* **1. Atomic explosion effects on weather.**—*E.Z.S.*

**11M–913** 551.509.6:

Anderson, Clinton P. (*U. S. Senator, N. Mexico*), **Toward greater control: high risks, hi stakes.** (In: Resources for the Future, Inc., **Science and resources for the future.** Baltimo Johns Hopkins Press, **1959.** p. 54–62.) **DLC** (Q171.R43)—The national and international implic tions of weather modifications are discussed, the implications being economic and sociological well as political and military. Although 14 states have passed weather modification laws of varyi effectiveness some legislation on a national scale is necessary. It is suggested that weather warfa may be an ultimate weapon. *Subject Headings:* **1. Weather control 2. United States.**—*E.Z.S.*

**11M–914** 551.509.617:551.578.7:632.116.3(4

Association d'Etudes des Moyens de Lutte Contre les Fléaux Atmosphériques, Toulous **[Compte Rendu],** No. 1, **1952.** Latest issue seen, No. 7, **1959.** Annual. About 50 p. per issu figs., photos, tables, refs.—This journal is devoted to reports on the struggle against atmospher catastrophes. Reports on hailstorms- their distribution, duration, and damaging effects are pr dominant. Numerous pictures illustrate cloud formations, especially those related to hailstorm Results of continuing experiments on seeding with silver iodide in S. W. France are reported in ea issue. Maps show the location of notable storms and seeding improvements by the "Association *Subject Headings:* **1. Hailstorm surveys 2. Silver iodide seeding experiments 3. Cloud seedi effects 3. Hail damage to agriculture 4. Hail prevention in France 5. France. I. Dessens, Hen** —*E.S.*

**11M–915** 551.509.617:546.57:546.15:551.578

Balabanova, V. N.; Bibilashvili, N. Sh.; Kartsivadze, A. I. et al., **Opyty po vozdeistviiu kuchevuiu oblachnost' v Alazanskoĭ doline.** [Experiments on influencing cumulus clouds in T Alazan Valley.] *Akademiia Nauk SSSR, Izvestiia, Ser. Geofiz.,* No. 2:262–275, Feb. **1959.** 11 fig (incl. photos), table, 5 refs. Transl. into English in the corresponding number of its *Bulletin of t Academy of Sciences, USSR, Geophysics Series.* **DLC**—The conditions of hail occurrence in t Alazan Valley in the Caucasus Mountains and the possibility of using AgI from ground generato

are discussed. This is followed by a description of the general operation and of the individual 14 experiments carried out during June 1956 during which clouds were seeded with AgI from ground generators. Positive results obtained in some instances indicate that it is possible to stimulate precipitation in cumulus clouds containing supercooled drops by means of AgI released by ground generators when suitable meteorological conditions prevail. A comparison of complex data on the physical state of the cloud before and after action (stratification of the atmosphere, thickness of cloud, etc.) and the trajectory of the smoke obtained by means of pibals can serve to evaluate the effect of seeding. Radar observations indicate that the characteristic of artificially areated zones of reflection during ground smoke generation is their origin at lower elevation (at 1.5–2.0 km) in comparison with the origin of natural zones of reflection. The method of ground seeding for introducing active substances into cumulus clouds is inadequate in Alazan Valley because the production of the effect depends upon ascending currents, which vary with time and place. The action on cumulus clouds to prevent hail formation is possible only when the cloud is developed up to the region of negative temperatures (−5, −10°C). However, at this time arises the danger of belated arrival of crystallization nuclei in connection with very rapid transition of cumulus clouds into hail (vertical velocity exceeds 20 m/sec) clouds. Experiments with burning red phosphorus directly in clouds showed that it is necessary to continue the investigation of the effect of hygroscopic substances on the warm part of the cloud. *Subject Headings:* **1. Cloud seeding with silver iodide 2. Artificial precipitation 3. Hail prevention.**—*I.L.D.*

**11M–916** 551.574.2:551.575.1:536.421:532.78:546.57:546.15

Balabanova, V. N., **O vliianii temperatury pereokhlazhdeniia tumanov na kristallizatsiiu ikh aerozolem iodistogo serebra.** [Influence of the supercooling temperature of fogs on their crystallization by AgI aerosols.] *Akademiia Nauk SSSR, Izvestiia, Ser. Geofizich.*, No. 6:924–929, **1959.** 3 figs., 7 tables, 3 refs. Transl. into English in the corresponding number of its *Bulletin of the Academy of Sciences, USSR, Geophysics Series.* **DLC**—The author carried out a series of experiments in order to test VONNEGUT'S evidence that the effectiveness of crystallization of fogs by AgI particles depends upon the temperature of supercooling of fog droplets and his explanation of this phenomenon on the assumption that the concentration of crystallization nuclei in a fog diminishes at the expense of their precipitation on the walls of the vessel and this precipitation on the walls is smaller the lower is the temperature. The experimental procedure and apparatus including the cloud chamber and the automatic trap for measuring the concentration of ice crystals for testing VONNEGUT'S data and assumptions are described and the results are presented in tables giving data on the influence of supercooling temperature on the amount of ice crystals formed in one cloud, the effect of supercooling temperature on the amount of AgI acting as crystallization nuclei, influence of products of burning of an electric arc upon crystallization of clouds, effect of duration of AgI particles upon amount of ice crystals formed etc. The results obtained lead to the following conclusions viz: (1) the effect of temperature upon crystallization of supercooled fogs by AgI dispersed either at 3000°C or 1000°C manifests itself primarily in the range up to −10°C; (2) VONNEGUT'S explanation of the mechanism of the effect of supercooling temperature by the action of the walls of the vessel was not confirmed; (3) the nature of the effect of supercooling temperature of fog on the crystallization by AgI is confirmed by the experiments of C. L. HOSLER. *Subject Headings:* **1. Supercooled fog 2. Silver iodide fog seeding.**—*I.L.D.*

**11M–917** 551.509.61:551.574.2:546.57:546.15

Balabanova, V. N.; Zhigalovskaia, T. N. and Maleev, M. N., **Vliianie temperatury vozdushnoĭ sredy na deĭstvie chastitsy iodistogo serebra v kachestve iader kristallizatsii.** [Influence of air-temperature on the activity of AgI particles as crystallization nuclei.] *Akademiia Nauk SSSR, Izvestiia, Ser. Geofiz.*, No. 12:1889–1890, Dec. **1959.** 4 tables, 4 refs. Transl. into English in the corresponding number of its *Bulletin of the Academy of Sciences, USSR, Geophysics Series.* **DWB, DLC**—On the basis of experimental data the author examines the problem of the dependence of the crystallization capacity of AgI particles upon the temperature of the atmosphere. Data showing the dependence of the observed number ($n$) of ice crystals in a cloud chamber upon the time that the smoke is in the chamber at different temperatures, the mean values of the amount of AgI settling ($m$) on the entire surface of the vessel during different time intervals, the amount of material remaining in the chamber in suspension for a given time and the ratio of $n_{20°}/n_{60°}$ and $m_{20°}/m_{60°}$. The basic cause of the decrease in the appearance of ice crystals in a cloud chamber as the temperature at which the smoke is maintained is increased, is the decrease in the concentration of AgI smoke as a result of the settling of particles upon the surface of the vessel before the release of smoke into the cloud chamber. Hence, the temperatures of the environment containing AgI in a closed vessel does not influence perceptibly the crystallization capacity of the particles. It is, therefore, assumed that also under natural conditions atmospheric temperature does not affect the activity of the AgI particles: the inactivation of such particles as crystallization nuclei is, in the atmosphere, a consequence of solar radiation. *Subject Headings:* **1. Silver iodide properties 2. Silver iodide decay.**—*I.L.D.*

**11M–918** 551.574.1:016(47) 551.509.6(47

†Battan, Louis J. (*Inst. Atmospheric Physics, Univ. Ariz.*), **Cloud physics research in the Sovie Union.** *American Meteorological Society, Bulletin*, 40(9):444 464, Sept. **1959.** Bibliog. p. 455–464 **DWB, DLC**—A most thorough review of recent (1948–58) Soviet research in cloud physics and clou seeding as evidenced by the published literature available in the U. S. Citations are unusuall complete although in every case to an English translation (or translated title). The 400-odd article are discussed under 10 main headings: 1) atmospheric nuclei and precipitation chemistry; 2) clou formation and structure; 3) cloud droplet spectra and liquid water content in clouds; 4) raindro spectra; 5) ice crystal and snowflake spectra; 6) precipitation processes; 7) atmospheric electricity 8) instruments; 9) radar; 10) cloud seeding and weather modification. The conclusion reached is tha research in cloud physics is advanced about as far as in the U. S., although in radar cloud physic studies and in silver iodide and warm cloud seeding techniques there is a considerable lag in th U.S.S.R. Many suggestions have been made and some experiments conducted for suppressing hail fog, stratus and cumulus clouds, for warming the polar regions with an artificial sun (thermonuclea reactor in a satellite), or nuclear explosions and for damming the Bering Strait, etc. The extensiv list of references is divided into two parts: one with actual translations available at the designate source, and the other with no translation yet discovered by the author. (*Same item as* 12.5–329 May 1951, *Met. Abs.*) *Subject Headings:* **1. Soviet cloud physics research 2. Cloud physic bibliographies 3. Weather modification research 4. U.S.S.R.**—*M.R.*

**11M–919** 551.509.616(791

Battan, Louis J. and Kassander, A. Richard, Jr., **Seeding of summer cumulus clouds.** *Arizona Univ. Institute of Atmospheric Physics, Scientific Report* No. 10, July 1, **1959.** 10 p. 2 figs. (incl photos), 3 tables, 2 refs. "Final Report to National Science Foundation under Grant No. NSF G5607."—A description is given of a program of randomized seeding of orographic cumuli ove southeastern Arizona. This investigation, started in 1957, is still in progress. The aims have bee to learn more about natural cloud processes and to ascertain if airborne silver iodide seedings ca modify them. It will be shown that analyses of cloud photographs, radar observations, lightnin observations and rainfall data suggest that cloud seeding modified the natural cloud processes However, the changes observed so far have not been large enough to conclude that effects hav positively been established. *Subject Headings:* **1. Cloud seeding 2. Cumulus cloud modificatio 3. Arizona.**—*Author's abstract.*

**11M–920** 551.509.616:551.578.7(45

Bilancini, Raoul, **La lotta antigrandine.** [Hail prevention.] *Rivista di Meteorologia Aero nautica*, Rome, 19(4):44–46, Oct./Dec. **1959.** Also: Rosini, E. and Vittori Antisari, Ottavio, A **proposito di lotta antigrandine.** [On the subject of hail prevention.] *Ibid.*, 20(1):57–58, Jan. March **1960. DLC**—From a preliminary report of the Research Program on Hail Producing Cloud carried out during the summer of 1958 the author cites a number of interesting items. The experi ments of 1958 were aimed at determining the efficacy of rockets as hail prevention devices. The action of rockets may be acoustical, mechanical, thermodynamical, microphysical and electrical. The theory of Ludlam which states that hail does not come from the top but from the base of cumu lonimbus clouds presents a possibility of human intervention, namely, increasing the number o drops at the base of a cloud by introducing rockets with large condensation nuclei such as NaC powder. The experiments, carried out in 1958 in the vicinity of Verona which aimed to test Ludlam's theory proved it effective in actuality. Rosini and Vittori Antisari state that a similar program was proposed and realized by the Ministry of Agriculture and Forestry, and the National Anti-Hai Union. A few ideas to this program are suggested. *Subject Headings:* **1. Hail prevention techniques 2. Verona, Italy.**—*I.L.D.*

**11M–921** 551.509.617:551.574.1:551.507.362.1(61

Brazell, J. H. and Taylor, C. M., **Artificial stimulation of rainfall in East Africa by means of rockets.** *East Africa. Meteorological Department, Memoirs*, 3(6), **1959.** 6 p. 2 figs., 1 table 9 refs. Shorter version in *Nature*, London, 181(4620):1421, May 17, **1958. DWB**—An experiment in artificial stimulation of rainfall conducted at Tabora, Tanganyika in 1956, using ground rockets is described. The seeding agent used was sodium chloride and the electrically-fired rockets carried a seeding charge of approximately one-and-a-half pounds, which was dispersed with explosive force in selected convective clouds. The experiment was controlled by a randomized procedure and cloud seeding took place over the Tabora reservoir catchment area, on which a rain-gage network was installed. Isohyetal patterns are given for total rainfall on seeding and non-seeding days. Some of the results appear significant. Sodium chloride is confirmed as an effective seeding agent in East Africa and seeding by rocket is accurate and efficient. Total rainfall immediately downwind of the rocket launching site on seeding days was appreciably greater than on non-seeding days. It appears

that clouds may be induced to rain earlier and heavier than they would have done naturally and there is evidence that clouds in certain stages of development, but unlikely to rain naturally, can be induced to precipitate. (*Same item as* 11.2–159, Feb. 1960, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding from rockets 2. Cloud seeding in East Africa 3. East Africa.**—*Authors' abstract.*

**11M–922** 551.509.617:551.578.72(675)

Bultot, Franz, **Etude statistique des chutes de grêle au Congo Belge et au Ruanda-Urundi.** [Statistical study of hailstorms in Belgian Congo and Ruanda-Urundi.] *Institut National pour l'Etude Agronomique du Congo Belge. Bureau Climatologique, Communication*, No. 17, **1959.** 43 p. 5 figs., 4 photos, 49 refs. **DLC**—At the end of this study the author briefly reviews current hail control techniques and concludes that it would be premature to attempt hail control in the Congo. (For abstract on the whole study *see* 10M–340, Suppl. No. 2, 1959, *Met. Abs.*) *Subject Headings:* **1. Hail distribution 2. Hail prevention 3. Belgian Congo.**—*A.V.*

**11M–923** 551.509.617

Byers, Horace R. (*Dept. of Met., Ohio U.*), **What are we doing about the weather?** (In: Resources for the Future, Inc., **Science and resources for the future.** Baltimore, Johns Hopkins Press, 1959. p. 37–53. 4 figs.) **DLC** (Q171.R43)—A brief discussion on the potentialities of cloud modification and its derivative rainmaking. The author stresses the fact that relatively little is known about this phase of weather processes, yet he does suggest that rainmaking, if properly understood, may be utilized. A series of precipitation experiments is outlined and evaluated. He points to the need to go through many basic steps in cloud physics before cloud modification can become practical. *Subject Headings:* **1. Cloud seeding potentialities 2. Cloud modification research.**—*E.S.*

**11M–924** 551.509.617(09)

Bowen, David, **Controlling the rainfall.** *Water Power*, London, 11(10):386–389. 5 figs., Oct. **1959. DLC**—"An outline of artificial rainmaking progress throughout the world with special reference to the adoption of this technique for improving the output of hydro-electric plants." The first scientific rainmaking experiments were carried out in 1946 by IRVING LANGMUIR and VINCENT SCHAEFER with carbon dioxide pellets (dry ice) applied to clouds containing water droplets below the freezing point to form ice crystals which then by chain reaction increased in number and in size. A year later BERNARD VONNEGUT demonstrated similar results with silver iodide crystals using coke generators. Further successes have been claimed by using other chemicals, including salt, but iodide is still the most favored seeding agent by ground based or aircraft seeding. One per cent of the water contained in a rain cloud released by this operation is sufficient to be of practical value. As an example of weather modification programs to increase snowpack, operations of the U. S. Water Resources Development Corporation in Arkansas and New Mexico in 1951–1952 are described as successful. Other operations in Spain and Switzerland are reviewed. Preoperational analysis of current conditions in the atmosphere is necessary to justify a program economically. Licensing laws demonstrate the growing success of modern rainmaking technique. A silver iodide generator is among the illustrations, as are various cloud formations. *Subject Heading:* **1. History of cloud seeding.**—*O.T.*

**11M–925** 551.509.617:551.578.7(45)

De Rossi, Fernando, **Sulla semina delle nubi con nuclei igroscopici giganti e gli esperimenti di difesa antigrandine effetuati nell'Italia settentrionale.** [Cloud seeding with large hygroscopic nuclei and experiments on hail prevention in northern Italy.] *Geofisica e Meteorologia*, Genoa, 7(3/4):82–83, May/Aug. **1959.** 2 refs. Italian and English summaries p. 83. **DWB**—Irrespective of the validity of LUDLAM'S theory on the formation of hail, which is not discussed in this article, it is pointed out that results, if any, of hail defense effected in Italy from 1949 to 1958 cannot be considered as supporting LUDLAM'S views. Moreover, said theory invalidates such results. (*Same item as* 12.2–255, May/Aug. 1959, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with salt 2. Hail prevention 3. Italy.**—*Author's abstract.*

**11M–926** 551.509.615/6:355

Downie, Currie S. and Silverman, Bernard A., **Military applications of supercooled cloud and fog dissipation.** *U. S. Air Force. Cambridge Research Center, Air Force Surveys in Geophysics*, No. 118, Dec. **1959.** 47 p. 14 figs., 11 refs. **DWB, DLC**—The physics of the dissipation of supercooled fog and stratiform clouds is examined briefly and results of Geophysics Research Directorate's dry-ice seeding investigations are presented. Four seeding missions are discussed in detail as examples of the meteorological conditions to which the technique is applicable and the results which can be anticipated. On one mission, below-minimum weather conditions at destination were modified to allow a safe and routine VFR landing. During certain periods of bad weather, the

seeding technique is shown to have potential application in military operation (such as the WWII interdiction, close-air-support missions, and visual and photographic reconnaissance). Military and civilian applications include the clearing of weather at airfields for landings and takeoffs. *Subject Headings:* **1. Potential fog dissipation 2. Cloud seeding with dry ice 3. Military meteorology.**—*Authors' abstract.*

**11M-927** 551.574.2:551.578.41

Fletcher, N. H., **A descriptive theory of the photo de-activation of silver iodide as an ice-crystal nucleus.** *Journal of Meteorology*, Boston, 16(3):249–255, June **1959.** 6 figs., 19 refs., 19 eqs. **DWB, DLC**—The photo de-activation of silver iodide as an ice-crystal nucleus is ascribed to the production of photolytic silver at trapping centers in the volume and on the surface of the nucleating particle. Silver produced at the surface raises the free energy of the interface between the nucleus and ice and so reduces the activity of the particle. The rate of de-activation is found to depend upon the size of the particle, and thus the size distribution of particles in a smoke has a strong influence upon its decay behavior. Calculations on the basis of this theory explain the wide variations in the decay rate reported in different experiments. *Subject Headings:* **1. Silver iodide decay 2. Ice crystal nuclei.**—*Author's abstract.*

**11M-928** 551.574.1:551.578.41

Fletcher, N. H., **On the ice-crystal production by aerosol particles.** *Journal of Meteorology*, Boston, 16(2):173–180, April **1959.** 7 figs., 17 refs., 15 eqs. **DWB, DLC**—The theoretical thermodynamic equations giving the rate of homogeneous nucleation, per unit volume, of embryos of critical size, rate of heterogeneous nucleation on a plane surface per unit area and the rate of nucleation of finite particles are presented. The results of theoretical calculations of the entire nucleation process are illustrated with graphs showing the supersaturation necessary to produce spherical nuclei at 0°C, the sublimation of ice onto nucleating particles from an environment at water saturation and freezing upon a particle suspended in water, etc. The behavior of nucleating particles indicates that almost all sufficiently large particles can act as sublimation nuclei at slightly less than water saturation if the temperature is lowered sufficiently; that in size ranges from 0.01 to 0.1 microns even particles wetted by water require considerable supersaturation to nucleate droplets but may act as sublimation nuclei at moderate supercoolings and water saturation near $S=11$; and that at very small supercoolings and slight supersaturation with respect to water, condensation is more rapid than sublimation. It is shown experimentally that AgI generally behaves like a sublimation nucleus. The size effect is used to explain the activity distribution of AgI smoke and this in turn explains the time lag observed in the nucleation of ice crystals by the smoke. *Subject Headings:* **1. Ice crystal nucleation 2. Nuclei effectiveness.**—*I.L.D. and author's abstract.*

**11M-929** 551.574.2:551.509.617

Fletcher, N. H. (*C. S. I. R. O. Radiophysics Lab., Sydney, Australia*), **The optimum performance of silver-iodide smoke generators.** *Journal of Meteorology*, Boston, 16(4):385 387, Aug. **1959.** 4 figs., 12 refs. **DWB, DLC**—The ice-forming ability of silver-iodide smoke depends upon the size of the smoke particles in a way which can be calculated. From this relation, it is possible to find the maximum number of nuclei produced, per gram of silver iodide, which are active at a given temperature. Comparison of the performance of such an ideal generator with that of experimental burners shows that optimum performance is being approached in some cases. *Subject Headings:* **1. Silver iodide smoke generators 2. Silver iodide nuclei.**—*Author's abstract.*

**11M-930** 551.509.617:551.574.2

Fournier d'Albe, E. M. (*UNESCO Mission, Inst. Ciencia Aplicada, Mexico, D. F., Mexico*), **Artificial cloud nucleation with sodium chloride.** *American Geophysical Union, Geophysical Monograph*, No. 3:106–110, **1959.** 2 figs., 2 tables, 10 refs. **DWB, DLC**—The paper discusses first the mechanism of rain formation in the light of various theoretical investigations. The role of giant hygroscopic nuclei in rain formation and its geographical distribution are considered. Using SQUIRE'S method the results of calculations of growth of droplets are tabulated. A summary of recent observations given in a paper by EAST, showing liquid mixing ratio and temperature at the initial radar echo, is also tabulated. Concentration and size distribution of natural hygroscopic nuclei is graphically represented. The paper then describes the various techniques of seeding with artificial hygroscopic particles. Size distribution of milled salt used in seeding from the ground is shown in the diagram. Finally, the problem of evaluation of these techniques is considered and the possibility of using a physico-chemical method as an aid in the evaluation of experiments in which salt is the seeding agent, is examined. (*Same item as* 12.1–265, 1959, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with salt 2. Hygroscopic nuclei.**—*I.S.*

**11M–931** 551.509.617:551.578.7(436)

Friedrich, Walther, **Hagelabwehr in Österreich.** [Hail prevention in Austria.] (summary only.) *Germany. Deutscher Wetterdienst, Berichte,* 8(54):110, **1959.** German summary p. 110. **DWB, DLC**—During the past three years hail prevention by means of AgI has been carried out in the Graz Basin (Austria). The height of ascent of the rockets was 1000 to 1500 m. The explosive contained AgI. The firing bases were brought as closely as possible within the center of the thunderstorm by means of trucks. The firing was also aimed. The results of experimentation showed the following, viz: snowfall resulted when a AgI rocket was fired at a temperature of 15°C. About 20% of all hail fell in a soft form. The new form produced by AgI was deposited on the falling supercooled hail nuclei. This soft hail did not cause damage. When small clouds were fired on with rockets the clouds dissolved, occasionally rapidly, with the formation and expansion of holes. In the area of Feldkirchen in Carinthia eight ground generators were set up in a semi-circle. The generators were operated three times per hour, each seeding lasting 5 minutes. *Subject Headings:* **1. Hail prevention in Austria 2. Cloud seeding with silver iodide 3. Graz Basin, Austria.**—*I.L.D.*

**11M–932** 551.509.615/6

Gaĭvoronskiĭ, I. I., **Ob issledovaniiakh, provedennykh v Tsentral'noĭ aerologicheskoĭ observatorii v oblasti iskusstvennykh vozdeĭstvii na oblaka i tumany.** [Investigations conducted at the Central Aerological Observatory on artificial influences on clouds and fogs.] *Moscow. Tsentral'naia Aerologicheskaia Observatoriia, Trudy,* No. 26:39–55, **1959.** 10 figs., table, 26 refs., eq. **DLC**—The work on artificial modification of cloud and fog conditions was initiated on large scale in 1921, but it was interrupted during the World War until 1947. In view of SCHAEFER'S discovery of the effect of carbon dioxide on the phase transformation of supercooled clouds and fog. The Central Aerological Observatory made special investigations of the mechanism of carbon dioxide and silver iodide effects on supercooled fog and also of the critical temperature for phase transitions. The theoretical and experimental methods in laboratories and the field are described in detail and illustrated. Special attention is given to the automatically controlled device for dry ice seeding from airplanes and from surface installations on airfields. Dense clouds of low and middle stratus were dispersed on Nov. 7, 1953 over a large area above Red Square in Moscow for clear visibility of the Red Air Force's parade. The use of silver iodide and lead iodide in combating fog and clouds and the equipment used are described in detail. The major problems in the development of effective methods for producing precipitation and preventing formation and fall of hail from storm clouds are summarized. *Subject Headings:* **1. Artificial cloud modification 2. Artificial fog dissipation.**—*N.P.S.*

**11M–933** 551.509.617 519.2

Genève, R., **Sur le contrôle statistique d'une opération de pluie artificielle.** [On statistical control of a cloud seeding operation.] *Puy de Dôme. Observatoire, Bulletin,* No. 1:1–6, Jan./March **1959.** 2 figs. **DWB**—Statistical study on artificial rain making carried out by the Water Resources Development Corporation in the Savoy Alps (France) from Oct. 1, 1954 to Oct. 1, 1958. From a few stations in the operational region, diagrams of regression are compared. This analysis made it clear that the precipitation upon the target is modified from the beginning of the operation. But the recent measurements after the end of seedings do not confirm this success. The series of observations on the inside of the target are not "naturally" homogeneous and hence their use is discouraged, whatever the method be: regression or deviation from the normal. The author is of the opinion that by the organization of artificial rain making in an intermittent way the difficulties of heterogeneity in series could be overcome. (*Same item as* 11.4–218, April 1960, *Met. Abs.*) *Subject Headings:* **1. Artificial precipitation 2. Cloud seeding evaluation 3. Savoy Alps, France.** —*A.V. and author's abstract.*

**11M–934** 551.509.617:342.5

†Grainger, George Richard, **Rain making: torts, property, injunction, landowner may enjoin cloudseeding directly above his land. Southwest Weather Research, Inc., v. Duncan, 319 S.W. 2d 940 (Tex. Civ. App.—El Paso 1958, error granted).** *Texas Law Review,* 37:799–803, **1959.** 35 refs. Photostat of separated pages. **DWB** (M09.67 G743ra)—A controversy in Texas between the cotton farmers and ranchers is dealt with. The cotton farmers protested against the damage to their crops caused by the cloud seeding. The court upheld the right of the ranchers for cloud seeding. The author discusses the matter in legal terms and proposes among four alternatives as the most desirable to analogize the right to precipitation to riparian rights. *Subject Heading:* **1. Weather control hearings.**—*A.H.K., O.T.*

**11M–935** 551.578.11:551.509.617:551.574.11:546.57:546.15

Gübeli, Otto, **Zur Bestimmung von Ultraspuren von Silberjodid in Regenwasser.** [Determination of minute traces of silver iodide in rainwater.] *Zeitschrift für Anewagndte Mathematik und*

*Physik*, Basel, 10(3):310–314, **1959.** fig., eqs. English summary, p. 314. **DWB, DLC**—A process is given for determining ultra-traces of silver iodide in rainwater following seeding experiments designed to influence precipitation. After considering the physico-chemical properties of silver iodide a 50-l sample of rainwater has been vaporized in a rapid 'thin-film' vaporizer. The residue is reduced by dissolving with soda. The reduced silver can be separated from the iodide by extraction with water. The quantitative analysis is then made by spot test on the basis of drops placed on filter paper saturated in p-dimethylaminobenzilidenerhodanine, compared with drops of known content or alternatively with non-seeded rainwater. The quantitative analysis of the iodide is made with the aqueous, soda-alkaline, silver-free extract. The iodide traces are enriched, oxydized, and made to react on strips of paper soaked in fluoresceinsodium. (*Same item as* 11.8–275, 1959, *Met. Abs.*) *Subject Headings:* **1. Rainwater analysis 2. Silver iodide in rainwater.**—*Author's abstract.*

**11M–936** 551.509.617(94)

Higgs, A. J., **Rainmaking in Australia.** *Hemisphere*, Melbourne, 3(12):2–7, Dec. **1959.** 6 figs. **DWB** (M09.67 H637ra)—Discussion on rainmaking activities in Australia with brief comments on the background of rainmaking in general. Extensive tests carried out in Australia have established that it is possible to provide substitutes for the naturally occurring freezing nuclei, and that these substitutes not only can trigger off the rain-forming process in suitable clouds, but sometimes can do it when the naturally occurring nuclei would not have been able to do so. Five controlled experiments are underway in Australia. The best methods of rainmaking we know of at the moment are ineffective in arid regions because suitable supercooled cloud systems occur there too infrequently; and tests show that they are also ineffective when the natural rainfall is already heavy. It is in the "in-between" rainfall regimes, that rainmaking is likely to be most effective. It seems that increases in the range 10–25% may well be feasible under favorable conditions. *Subject Headings:* **1. Cloud seeding in Australia 2. Australia.**—*E.Z.S.*

**11M–937** 551.575.1:551.591.1:551.509.61

†Israel, Hans and Kasten, Fritz, **Die Sichtweite im Nebel und die Möglichkeiten ihrer künstlichen Beeinflussung.** [Visibility in fog and possibilities of artificially influencing it.] *North Rhein-Westphalia, Germany. Ministerium f. Wirtschaft-und Verkehrswesen, Forschungsberichte*, No. 640, **1959.** 76 p. 20 figs., 3 tables, bibliog. p. 68–76, 30 eqs. **DWB** (M75.1 I85si)—The contents of this theoretical and experimental study on artificial control of visibility in fog comprise the following, viz: a detailed presentation of KOSCHMIEDER'S theory of horizontal visibility and measurement of visibility by means of KOSCHMIEDER'S formula; the relationship between visibility and the physical magnitude of fog such as drop radius, drop concentration, and water content; the TRABERT formula for measuring light extinction; the effect of external influences upon visibility, namely evaporation of drops by raising the temperature of the surrounding air above the dew point or evaporation by diffusion (seeding the fog with particles with a lower vapor pressure than the fog droplets), mechanical removal of fog particles by increasing fog droplet size through "internal coagulation" of fog (turbulence or electrical neutralization of fog); enlargement of fog droplets by condensation, removal of fog drops by condensation with large water drops freely falling through the fog; cloud (fog) dissolution by rain including temporal change of water content of a cloud by falling rain and cloud dissolution by natural rain; precipitation production in a cloud by artificial rain (seeding with water drops); laboratory experiments for improving visibility in clouds, including production of a constant cloud of temporally constant visibility; measurement of visibility and droplet size, the artificial control of laboratory fog by seeding with active-surface powder, and seeding with active-surface solution; field experiments for improving visibility in fog including comparison of laboratory with natural fog, description of water ejectors employed in the field experiments and the results of the field experiments. The field experiments showed that the water ejectors had no influence upon fogs with a visibility of 300–400 meters. In the only instance of a fog with a visibility of less than 100 meters visibility was improved by 10–15%. (*Same item as* 11.10–362, Oct. 1960, *Met. Abs.*) *Subject Headings:* **1. Visibility in fog 2. Fog particle investigation 3. Artificial fog dissipation.** —*I.L.D.*

**11M–938** 551.509.617(569.4)

Jaffe, S. and Rapaport, I. E., **Artificial stimulation of precipitation in Israel.** *Israel. Meteorological Service, [Publications], Series D, Contributions*, No. 12, Dec. **1959.** 17 p. 2 figs., 11 foot-refs. **DWB**—The natural process of precipitation and the possibility of influencing it artificially are investigated in its relation to Israel's climate. The natural process of precipitation, the "cold" and "warm" theories as means of artificial precipitation are explained. A climatological introduction is illustrated by a weather chart; then Project Cirrus and LANGMUIR'S theory are reviewed as the basis to the evaluation of cloud seeding experiments in Israel which started in March 1949. These experiments involved 1) seeding from aircraft, 2) from a single ground generator, 3) seeding of a target in Central Israel from ground generators, and 4) seeding in Northern Israel

from ground generators on randomly chosen days. The total accumulated precipitation during 3 operational seasons, Oct. 1953 -May 1956 is shown on a map based on the final report of the American Institute of Aerological Research in October 1957. The last part of the report is devoted to laboratory investigations. *Subject Headings:* **1. Cloud seeding in Israel 2. Cloud seeding techniques 3. Israel.**—*O.T.*

**11M-939** 551.509.6

Kahan, Archie M., **Weather modification: panacea or pipedream?** *Stanford Research Institute, SRI Journal*, 3:67–74, **1959.** figs.—Describes in detail ways and means to modify weather. In many countries governments have taken active part attempts to do so. Weather modification depends upon supplying critical amounts of energy at the proper time and place. Explosives are used to generate rainfall. Heat is effective in producing or dissipating clouds. Artificial nucleation is expected to have wide applications in the years to come. Diversion of warm ocean currents, towing of large ice floes northward from Antarctica are under consideration. *Subject Heading:* **1. Weather control.**—*A.H.K.*

**11M–940** 551.575.1:629.13.015

Le Claire, R., **Le brouillard demeure le grand ennemi de l'aviation.** [Fog remains the great foe of aviation.] *Schweizer Aero-Revue*, Zurich, 34(6):349–350, June **1959.** fig. **DLC**—Short survey of the disturbances caused by fog in aerial navigation and description of a recent landing method used when visibility is zero. This method has been perfected by the special Blind Landing Experimental Unit (B.L.E.U.) a division of the Royal Aircraft Establishment. A transmitter located at the end of the runway emits in the axis of the runway a beam which may be picked up by the aircraft. The signals caught present different frequencies on both sides of the axis. All along the axis itself intensity of impulses remains unchanged and thus it is possible through the use of the automatic pilot to line up plane and runway. This is in contrast to the method used in England during the World War II which consisted in the use of gasoline burners spaced out all along the runway. (*Same item as* 10.11–68, Nov. 1959, *Met. Abs.*) *Subject Headings:* **1. Fog effects on air traffic 2. Airport landing aids 3. Fog prevention.**—*A.V.*

**11M–941** 551.510.42:551.594:551.509.615

Lot, Fernand, **Hautes tensions et poussières électrisées.** [High voltages and electrified dust.] *La Nature*, Paris, No. 3291:316 317, July **1959.** 4 figs. **DLC**—Short review of the research, laws and applications of dust particles in electric fields. Among the applications, author mentions ultrafilters for industrial dust, high voltage generator with electrified particles and the experiments concerned with fog dispersal at positive temperatures. Ionized dust is ejected at a speed of 50 m/sec. and rises to about 50 m; at this level it creates an electric field capable of gradually sweeping the fog droplets away. Tests were made at the Paris-Orly-airport where a 10 m high funnel, equipped with an ionizer, can catch and send into the atmosphere a strong air current containing dust from a stream generating station. The field obtained spreads over a great number of hectares, and can reach 30,000 V/m at surface level. (*Same item as* 11.4–220, April 1960, *Met. Abs.*) *Subject Headings:* **1. Dust in electric fields 2. Artificial fog dissipation 3. Paris-Orly Airport, France.**—*A.V.*

**11M–942** 551.574.1:551.578.11 551.509.617

Mason, B. J. (*Imperial College, London*), **Recent developments in the physics of rain and rainmaking.** *Weather*, London, 14(3):81–97, March **1959.** 14 figs. (incl. photos), table, refs. **DWB, DLC**—Several interesting laboratory experiments into the dynamics and microphysics controlling the processes within a precipitation cloud are reported. Droplets of 30$\mu$ diameter were found to coalesce with smaller droplets (10$\mu$) when falling through them, but not if the smaller droplets have diameters $<5\mu$. This agreement with HOCKING'S computations will be pursued quantitatively. Spontaneous nucleation of 1$\mu$ drops at $-41°$C and 1 mm drops at $-33°$C without presence of foreign nuclei is experimentally proven. Quite interesting is the phenomenon of explosion of the thin ice shell of a raindrop, splinters of which are + charged leaving the residual drop with a negative charge of $10^{-12}$ coulomb. The charge mechanism is under investigation and may have bearing on thunderstorm electricity. *Subject Headings:* **1. Cloud physics 2. Raindrop coalescence 3. Artificial precipitation.**—*W.N.*

**11M–943** 551.509.615:551.576.11:551.574.2

Morachevskiĭ, V. G. and Nikandrov, V. Ia., **Effektivnost' chastits $CO_2$ i dyma AgI dlia rasseivaniia pereokhlazhdennykh nizkikh oblakov i tumanov.** [The effectiveness of $CO_2$ particles and AgI smoke in dissipating supercooled low clouds and fog.] *Leningrad. Arkticheskiĭ i Antarkticheskiĭ Nauchno-Issledovatel'skiĭ Institut, Trudy*, 228(1):135–145, **1959.** 4 figs., 2 tables, charts, 6 refs. **DLC**—Twenty airplane soundings of stratocumulus and stratus clouds and fog made in the Arctic with dry ice are described in detail. Results are presented in a table giving thickness of the

cloud or fog, temperature, wind speed, rate of seeding, time of crystal formation and effects observed. Seeding was found to be effective in dissipating low clouds and fog, not thicker than 500 m, at temperatures of −4°C and below. One experiment was also made with silver iodide which was found to be effective at −5°C or below. *Subject Headings:* **1. Artificial fog dissipation 2. Artificial cloud dispersal 3. Silver iodide fog dissipation.**—*G.T.*

**11M–944** 551.576.1:551.577.21:551.509.617

Muchnik, V. M., **Otsenka vodnosnosti kuchevo-dozhedvykh oblakov.** [Evaluation of the water content of cumulonimbus clouds.] *Kiev, Ukraine Nauchno-Issledovatel'skii Gidrometeorologicheskii Institut, Trudy*, No. 18:76–85, **1959.** 4 tables, 19 refs., eq. **DWB**—In spite of successful developments in methods of cloud seeding, there is still no sufficiently convincing evidence that they have resulted in greater efficiency, because evaluation of the results is rather complex. It is also difficult to estimate the amount of precipitation that can be obtained from various types of clouds. Such an attempt was made for clouds at a warm front. Using data on water content of cumulonimbus clouds, it was determined and measured precipitation amounts, ratios of water content to precipitation rate were determined. An extensive discussion of a number of authors and experiments on cloud seeding and water content of cloud formations is included. *Subject Headings:* **1. Cumulonimbus clouds 2. Water content of clouds—precipitation amount relationships 3. Cloud seeding effectiveness.**—*M.B.G.*

**11M–945** 551.509.617

Perelet, G. I. and Prikhot'ko, G. E., **Nekotorye voprosy teorii osazhdeniia sloistykh i sloisto-kuchevykh oblakov.** [Some problems in the theory of seeding stratus and stratocumulus clouds.] *Kiev, Ukraine. Nauchno-Issledovatel'skii Gidrometeorologicheskii Institut, Trudy*, No. 17:3–15, **1959.** 3 figs., 56 eqs. **DWB**—The authors attempt to develop a series of approximate computational formulas for determining the amount of moisture which may be obtained by artificial seeding of stratus and stratocumulus clouds. Since stratus clouds usually move with a velocity equal to that of the air currents at the level of their position it is possible to conceive a continuous ejection of cloud moisture along a comparatively narrow zone during the entire movement of the cloud mass if continuously operating generators are set up along the path of movement. This involves the "linear action upon clouds." Another method of seeding involves the simultaneous and periodic action upon an area of a cloud. In the case of linear seeding the authors develop formulas for determining the total precipitation amount that may fall on the surface of the earth without taking into account its distribution over the earth's surface, the amount of rainfall produced on the assumption that moisture falling from a cloud is distributed uniformly over the entire precipitation area, the amount precipitated if it is assumed that the intensity of moisture precipitation is a maximum at the beginning and then decreases linearly, and on the assumption that at the beginning the amount of precipitation increases, then beginning with some value $x = Lq$ it drops to zero ($Lq$ =section of the line). Formulas for calculating the quantity of precipitation falling from clouds seeded over a limited area and for determining the distribution of precipitation within the precipitation zone are developed. *Subject Headings:* **1. Cloud seeding of stratus clouds 2. Cloud seeding techniques.**—*I.L.D.*

**11M–946** 551.577.3:551.509.617:662.2:539.1

Pflugbeil, Carl (*Hamburg*), **Globale Niederschlagsabweichungen 1955–1957.** [World precipitation deviations, 1955–1957.] *Annalen der Meteorologie*, Hamburg, 8(11/12):353–357, **1959.** 2 figs., 4 refs. **DWB, DLC**—The possible relationship between precipitation during the period 1955–1957 and nuclear explosions is examined. A graph showing the mean deviations of global precipitation from the normal for 1953 to 1957 by station and month based upon CLIMAT data and the simultaneous nuclear explosions is presented. The greatest precipitation occurred during October 1955 but this precipitation cannot be associated with any nuclear explosions since the latter occurred on May 5, 1954. The second highest precipitation in March 1956 can be related formally to the nuclear explosion of Nov. 22, 1955 near Lake Baikal. The repeated nuclear explosions of May–August 1956 were followed by months with rainfall deficits. When the annual mean of precipitation deviation by station is considered there is evident a trend in recent years of a decrease in the initial above normal global precipitation in spite of the increase in nuclear explosions. The absolute fluctuations of monthly deviations of precipitation have not altered substantially during the past 3 years. The possibility that a nuclear explosion influences the general circulation is considered and it is mentioned that a single storm front moving over land liberates 1000 times as much energy as one nuclear explosion. The effect of nuclear explosions upon electrical conductivity of the atmosphere and a possible alteration of the ozone content of the upper layers has been studied by H. Byers and Donald R. Fitzgerald and by A. Schneiderov and their conclusions are summarized briefly. (*Same item as* 11.11–233, 1959, *Met. Abs.*) *Subject Headings:* **1. Global precipitation variations 2. Atomic explosion effects on weather.**—*I.L.D.*

**11M–947** 551.574.11:551.578.41 551.509.617:546.57:546.15

Raghavan, K. (*Met. Office, Poona*), **The suitability of the Cape Comorin area for testing cloud seeding techniques.** *Indian Journal of Meteorology and Geophysics*, Delhi, 10(3):291–294, July 1959. 4 figs., 3 tables, 3 refs. **DWB, DLC**—The areal distribution of rainfall in the southwest corner of the Peninsula is studied for the month of July. Suitability of control and target stations for testing seeding techniques in the area of Cape Comorin is discussed and essential conditions for the test are stipulated. (*Same item as* 12.1–269, July 1959, *Met. Abs.*) *Subject Headings:* **1. Rainfall distribution 2. Cloud seeding evaluation 3. Cape Comorin, India.**—*Author's abstract.*

**11M–948** 551.509.617:537.2

Ramana Murthy, Bh. V., **Artificial inducement of rain by electrostatic stimulation of clouds.** (In: Symposium on Meteorological and Hydrological Aspects of Floods in India, New Delhi, April 1958, **Proceedings.** Delhi, Indian Meteorological Dept., **1959.** p. 113–114. 4 refs.) **DWB** (M79.4 S989pr)—Alternate means of electrostatic stimulation applicable to all types of clouds are discussed. Superposition of a strong electric field is necessary for the growth of coalescence. Opposite charges of the order of $10^{-5}$ E.S.U. increased the collection efficiency of uncharged droplets two or three times. Attraction due to residual and acquired charges, and charged droplets, influenced by electric field, result in increase of coalescence efficiency, leading to formation of rain drops and rain. Considerable engineering skill will be needed to reproduce the laboratory experiment for field operations. Preliminary tests of an equipment being fitted in a Lincoln Bomber were designed by Radio-physics Laboratory, Sydney. *Subject Headings:* **1. Cloud seeding techniques 2. Electrostatic stimulation of clouds.**—*Author's abstract.*

**11M–949** 551.509.616/7:551.577.38:627.51

Roy, A. K. (*Council of Scientific and Industrial Research, New Delhi*), **Possibilities of control of drought and floods by present known techniques of cloud modification.** (In: Symposium on Meteorological and Hydrological Aspects of Floods in India, New Delhi, April 1958, **Proceedings.** Delhi, Indian Meteorological Dept., **1959.** p. 103–108. table, 5 refs.) **DWB** (M79.4 S989pr)—Giving consideration to the relative parts played by the various factors in determining rainfall from a cloud, and considering that cloud seeding techniques at present seek to modify only one of these cloud variables, an examination is made in a general way of the possibilities of control of weather or rainfall by such means, with reference particularly to clouds of the "warm" type over tropical regions. *Subject Headings:* **1. Cloud modification research 2. Drought control 3. Flood control.**—*Author's abstract.*

**11M–950** 551.509.616:551.576.11(545)

Savur, S. R., **New method for artificial stimulation of clouds.** (In: Symposium on Meteorological and Hydrological Aspects of Floods in India, New Delhi, April 1958, **Proceedings.** Delhi, Indian Meteorological Dept., **1959.** p. 109–112. fig., table). **DWB** (M79.4 S989pr)—The results of the performance of a simple and comparatively inexpensive device, the "steam generator" for artificially stimulating clouds to yield rain are reported here. *Subject Headings:* **1. Cloud modification experiments 2. Artificial precipitation techniques 3. New Delhi, India.**—*Author's abstract.*

**11M–951** 551.574.1 551.509.617:546.57:546.15(786)

Schaefer, Vincent J. (*Schenectady, N. Y.*) and Dieterich, John H. (*Missoula, Mont.*), **The seeding of cumulus clouds by ground-based silver iodide generators.** *Zeitschrift für Angewandte Mathematik und Physik*, Basel, 10(2):174–188, **1959.** 8 figs., 11 refs. **DLC**—Cloud seeding operations during the 1957 season of Project Skyfire in western Montana are described in detail. The experiments were conducted under closely controlled conditions, and visible results were recorded photographically (sample photographs are presented). The experiments are found to show conclusively "that it is quite feasible to introduce enough silver iodide into cumulus clouds by suitably located AgI ground based generators to produce unnatural effects wherever the clouds were colder than −40°C. The complete change from subcooled cloud droplets to masses of ice crystals occurs rapidly and produces spectacular changes." (*Same item as* 12.1–270, 1959, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding with silver iodide 2. Project Skyfire 3. Silver iodide smoke generators 4. Western Montana.**—*G.T.*

**11M–952** 551.509.615:551.575.1:551.591.1

Serpolay, R. (*Puy de Dôme. Obs.*), **Expériences d'amélioration de la visibilité par temps de brouillard, Aéroport de Paris-Orly, hiver 1958/59.** [Experiments for the purpose of improving visibility in foggy weather at the Paris-Orly Airport, winter 1958/59.] *Puy de Dôme. Observatoire, Bulletin*, No. 2:43–63, April/June **1959.** 6 figs., 2 tables, 10 refs. English and French summaries, p. 43. **DWB**—Experiments to improve the visibility on the runways in foggy weather and in temperatures lower than 0°C were conducted at Paris-Orly Airport during the cold season 1958–59.

The method and the various means of investigation used in the experiments are described. The results concerning the increase of visibility obtained from various initial conditions are presented and their meaning with regard to the present operation of the Airport is discussed. During the experiments liquid propane pulverizations were used for fog seeding. The results obtained show that propane does not dissipate fog but improves the visibility by modifying it. (*Same item as* 11.4–216, April, 1960, *Met. Abs.*) *Subject Headings:* **1. Artificial fog dissipation 2. Fog seeding experiments 3. Airport visibility control 4. Paris-Orly Airport.**—*Author's abstract.*

**11M–953** 551.509.6:061.3

Sievers, John R., **Notes on the Skyline Conference.** *American Meteorological Society, Bulletin*, 40(10):498;518, Oct. **1959. DWB, DLC**—A Conference was held on May 1–3, 1959, on the Design and Conduct of Research Programs in Weather Modification. A group of thirty scientists attended the Conference at Big Meadows Lodge located on the Skyline Drive of the Shenandoah National Park, Virginia. The Conference was sponsored by the Division of Mathematics, National Academy of Sciences—National Research Council, with the support of the National Science Foundation. The informal sessions were designed to inform and provoke discussions on various phases of cloud physics and precipitation. *Subject Headings:* **1. Cloud physics conferences 2. Weather modification conferences.**

**11M–954** 551.509.6:061.3(755)

Skyline Conference on the Design and Conduct of Experiments in Weather Modification, Shenandoah National Park, May 1–3, 1959, **Report.** *National Research Council, Wash., D. C., Publication*, No. 742, **1959.** 24 p. 17 refs. **DLC** (QC928.S5 1959c)—Conference promoted discussions in the field of design and conduct of experiments in the various current weather modification programs and research studies in progress. Report covers conclusions and recommendations of the Conference; the physical basis for weather modification activities; international programs in storm surveys, cloud seeding, and lightning suppression. Points out research needs in instrumentation and weather modification techniques. *Subject Headings:* **1. Weather modification conferences.**

**11M–955** 551.509.617(94)

Smith, E. J., **Artificial rainmaking.** *Power Farming in Australia and New Zealand* and *Better Farming Digest*, Sidney, 68(6):10–13; 15, June **1959. DA** (58.8 P87)—The development of natural rain is explained and demonstrated by an instructive diagram. The evolution of artificial rainmaking is outlined, with special regard to the efforts made in Australia. *Subject Headings:* **1. Progress in cloud seeding 2. Australia.**—*O.T.*

**11M–956** 551.509.615:621.43.06:629.135.2

Smith, Robert B. and Wexler, Raymond, **A test of the feasibility of the use of jet engine exhaust heat for fog dissipation.** Allied Research Associates, Inc., Boston Contract AF 19(604)-3492 (Research directed toward contrail elimination), Final Report, Pt. I, March 31, **1959.** 20 p. 10 figs. (incl. photos), 2 tables, 4 refs., eqs. **DWB**—Measurements of temperature and wind speed in the exhaust plume of a jet aircraft operating on the ground were made to investigate the feasibility of the use of jet engine exhaust heat to dissipate fog from airport runways. Bead thermister thermometers and anemometers, suspended from kytoons which were towed by trucks, were used to make the measurements. A field test in a calm showed that temperature rises of 2°F above ambient reached 200 ft above the runway over a width of 200 ft at distances of 300–600 ft behind the tail pipe. Maximum induced wind speeds in this region were about 20 mph. Based on the results of this experiment a fog dissipation technique for airport runways using jet exhaust heat seems feasible for fogs warmer than about 30°F. (*Same item as* 12.2–249, March 31, 1959, *Met. Abs.*) *Subject Headings:* **1. Fog dissipation by jet exhaust 2. Jet aircraft.**—*Author's abstract.*

**11M–957** 551.509.615/6

Smith, Robert B.; Wexler, Raymond and Glaser, Arnold H., **Modification of fog and cloud particles in the atmosphere.** Allied Research Associates, Inc., Boston, Contract AF 19(604)-3492, Final Report, Pt. 2, March 31, **1959.** 47 p. 6 figs., 8 tables, 7 refs., 23 eqs. **DWB**—Pt. 2 of the report deals with aspects of artificial fog and cloud modification. A number of studies and experiments on dry-ice crushing and disseminating equipment led to a suggested improved design. Analysis of 22 dry-ice seeding missions performed by the Air Force Cambridge Research Center showed significant correlations among maximum area of hole created in clouds, time to form maximum hole, weight dry ice used, and length of seeding track. Tests of the possibility of the use of mortar projectiles for the dissemination of dry ice in supercooled fogs such as occur at Elmendorf AFB, Alaska, were encouraging. The possibility of the reduction or suppression of fogs by the use of hexadecanol to prevent evaporation from nearby free water surfaces is discussed. Evaporation of some fog and small clouds through the absorption of sunlight by pollutants added to the cloud seems possible

on the basis of calculations of the effect of carbon black seeding, as well as more general theoretical considerations. (*Same item as* 12.2–250, March 31, 1959, *Met. Abs.*) *Subject Headings:* **1. Artificial cloud modification 2. Artificial fog dissipation.**—*Authors' abstract.*

**11M–958** 551.509.615:551.575:536.421

Soulage, G., **Précipitation de brouillards surfondus au moyen de neige carbonique.** [Precipitation of supercooled fog by means of dry ice.] *Puy de Dôme. Observatoire, Bulletin*, No. 4:147–149, Oct./Dec. **1959.** 10 refs. **DWB**—Dry ice, silver iodide and propane are the principal cold-producing substances which were used during tests for supercooled fog precipitation. Dry ice appeared to be the least effective. With a view to verify this assertion, experiments were conducted in the region of Clermont-Ferrand. Dry ice was dispersed in the atmosphere with two liquid gas bottles, fitted on the rear platform of a light truck. The dry ice was dispersed upwards to three or four meters from the soil. The temperature of the fog varied locally from −1.5 to −4.5°C. In each case the supercooled stratus was locally transformed into ice-crystal clouds. The dry ice acts like a freezing agent very near 0°C. Certain experiments gave very light and localized precipitation, and one produced heavy snowfall followed by a great improvement in visibility. The dry ice thus permits, in certain cases, to precipitate supercooled fog as do silver iodide and propane. It has appeared that besides temperature and wind, the stability and turbulence factors play an important part in the precipitation and dissipation of supercooled fogs. The qualitative results obtained appear to indicate that no important difference in effectiveness exists between dry ice and propane. Silver iodide however seems to have a more extended and more regular action but it requires lower temperatures (inferior to −4°C). (*Same item as* 11.10–255, Oct./Dec. 1959, *Met. Abs.*) *Subject Headings:* **1. Fog precipitation 2. Fog seeding 3. Fog dissipation 4. Cloud seeding effectiveness.**—*A.V.*

**11M–959** 551.509.617:(545)

Srivastava, R. C. (*Council of Scientific and Industrial Research, New Delhi*), **On the methods of evaluation of artificial rain-making experiments.** (In: Symposium on Meteorological and Hydrological Aspects of Floods in India, New Delhi, April 1958, **Proceedings.** Delhi, Indian Meteorological Dept., **1959.** p. 115–122. 3 figs., 5 refs.) **DWB** (M79.4 S989pr)—The scientific basis of the experiments conducted in recent years on artificial inducement of rain in certain types of clouds is reviewed briefly. Importance of making a rational unbiased assessment of such experiments is stressed and limitations of some of the conventional methods of analysis of the results are discussed in some detail. *Subject Headings:* **1. Cloud seeding evaluation 2. New Delhi, India.**—*Author's abstract.*

**11M–960** 551.509.617:551.578.7(494.5)

Switzerland. Eidg. Kommission zum Studium der Hagelbildung und Hagelabwehr. **Grossversuch III zur Bekämpfung des Hagels im Tessin. 2. Versuchsjahr.** [**Project 3 for hail control in Ticino, second year of experiment.**] Its *Tätigkeitsbericht*, No. 11, 1958, issued **1959.** 105 p. 8 figs., 32 tables. Mimeog. **DWB**—(For reports on earlier experiments, *see* 11M–657, –749, –830 and –897.) Tabulated weather and experimental data for 1958 are presented similarly to that of the previous year. The tests do not permit as yet conclusions of statistical value regarding the effect of seeding. There are, however, indications of a marked increase in rainfall in the northern part of the test area which has a marked orographic character. Therefore an active nucleating effect of silver iodide ground generators is probable. The continuation of the experiments will prove a definite positive, negative or neutral decision about the influence of seeding on hail formation (for later report *see* 11M–1011). *Subject Headings:* **1. Hail prevention in Switzerland 2. Ticino, Switzerland.**—*O.T.*

**11M–961** 551.509.617:551.578.7

Tomsich, G., **La lotta contro la grandine a una svolta decisiva.** [Hail control at a decisive turn.] *Cuneo. Camera di Commercio Industria e Agricultura, Notiziario Cambrale*, 14(2):42 43. Jan. 31, **1959. DA** (287 C91)—Reviews previous experiments, chiefly those in Italy and France, and research, chiefly in the United States. FRANK LUDLAM'S theory as stated at the Cloud Physics Institute of London University, represents a revolutionary decisive turn in effective hail control. *Subject Heading:* **1. Hail prevention.**—*O.T.*

**11M 962** 551.509.6:061.6

U. S. Congress. House. Committee on Science and Astronautics, **Weather modification. Hearing before the Committee, 86th Congress, First Session, Feb. 16, 1959.** Wash., Govt. Print. Office, **1959.** 47 p. tables. **DLC** (QC928.U47)—Testimony of DR. ROBERT BRODE, Associate Director of Research of the N. S. F., DR. EARL DROESSLER of N. S. F., and DR. RUBEN GUSTAVSON, President of Resources for the Future of the Ford Foundation and Chairman of the N. S. F. Advisory Group on Weather Modification concerning legislation in support of laboratory and field studies,

evaluation, and conferences for Weather Modification Program of N. S. F. in 1959-60. Grants up to Feb. 16, 1959, activities of Government agencies and N. S. F. support of IGY, Antarctic program etc. in meteorology are also listed and discussed. *Subject Headings:* **1. Weather modification program of N. S. F.**—*M.R.*

**11M-963** 551.509.617:0

†U. S. Weather Bureau, **Summary report on progress and possibilities in weather modification.** Prepared for the Select Committee on National Water Resources, U. S. Senate. Wash., D. C. Oct. **1959.** 73 p. 7 figs., appendices, 39 refs. **DWB** (MO9.6 U587 su)—In addition to the genera techniques of inducing precipitation by the use of solid carbon dioxide and silver iodide dispensed from rockets, balloons and ground generators, there have been a number of important contributions recently made in the U. S., the United Kingdom, Australia, Switzerland, African Congo Basin British East Africa, and the U.S.S.R. These new techniques are reviewed in this summary report. *Subject Headings:* **1. Progress in cloud seeding 2. Cloud seeding techniques.**—*N.N.*

**11M-964** 551.509.617:551.508.99:629.13

Voskresenskiĭ, A. I. and Morachevskiĭ, V. G., **Apparatura dlia vozdeĭstvii na pereokhlazhdennye oblaka i tumany s samoleta.** [Equipment for seeding supercooled clouds and fog from an airplane.] *Leningrad. Arkticheskiĭ i Antarkticheskiĭ Nauchno-Issledovatel'skiĭ Institut, Trudy*, 228(1):155-161 **1959.** 3 figs., 4 refs. **DLC**—Two airborne devices have been developed by the authors at the Leningrad Main Geophysical Observatory. One is a silver iodide smoke generator in which AgI is burned under pressure by electrical heating. The advantages of this apparatus are controlled output and elimination of fire hazard inherent in open burners. Construction and operation are described in all technical detail and a diagram of the assembly is presented. The other device produces dry ice pellets 1-8 mm in diameter from liquid $CO_2$ at a rate of 180-540 g/min. Both generators have been successfully used in seeding low clouds and fog in the Arctic. *Subject Headings:* **1. Cloud seeding from airplane 2. Silver iodide smoke generators.**—*G.T.*

**11M-965** 551.577.52:634.956(478)

Whiten, A. J., **Accomplishment and rumour.** *Weather*, London, 14(6):208-210, June **1959. DWB**—Dr. Drogaitsev, Russian marine meteorologist, explained that measurements showed beyond reasonable doubt that local precipitation had been substantially increased by the presence of new forests. He discounted many notions of gigantic achievements. Both he and the writer expressed an interest in long range forecasting for its benefit in agricultural management but both disclaimed any effort to modify rainfall patterns over large areas. Some improvements on the Volga are mentioned. (*Same item as* 12.8-369, Aug. 1961, *Met. Abs.*) *Subject Headings:* **1. Forest effects on precipitation 2. Afforestation 3. Volga region, U.S.S.R. I. Drogaitsev, D. A.**—*E.Z.S.*

**11M-966** 551.509.617(510)

**Opytnyĭ doklad o iskusstvennom padenii, dozhdia v provintsii Girin.** [Report on artificial precipitation experiments in Kirin Province.] *Acta Meteorologica Sinica*, Peking, 30(1):5-10 Feb. **1959.** In Chinese; Russian summary p. 10. **DLC**—Twenty experiments of artificial rain making with the aid of solid $CO_2$ were carried out between Aug. 8 and Sept. 18, 1958 with good results. The amount of water obtained during the experiments was approximately $66 \times 10^6$ cubic meters. The problem of utilizing this water for agricultural purposes was successfully solved. *Subject Headings:* **1. Cloud seeding in China 2. Cloud seeding with dry ice 3. Girin Province, China.**—*A.M.P.*

**11M-967** 551.509.617(510)

**Opytnyĭ doklad o iskusstvennom padenii dozhdia v provintsii Gan'su v mesiatsy 8-10 1958 g.** [Report on artificial precipitation experiments in Kansu Province Aug.-Oct. 1958.] *Acta Meteorologica Sinica*, Peking, 30(1):11-21, Feb. **1959.** 25 figs. (incl. photos), 6 tables, 4 refs. In Chinese; Russian summary p. 21. **DLC**—In the present paper the author discusses the process of artificial rainmaking, draws conclusions of its efficiency and shows that the different effects of convective cloud seeding depend on the kind of seeding agent used. The results of the study show that there is a real possibility of producing artificial precipitation in the Hanshu Province. *Subject Headings:* **1. Cloud seeding in China 2. Kansu Province, China.**—*A.M.P.*

**11M-968** 551.509.616(510)

**Opytnyĭ doklad o iskusstvennom rozhdenii oblaka nad gorodom Nankin 27go noiabria 1958 g.** [Report on experiments on artificial stimulation of clouds in Nanking on Nov. 27, 1958.] *Acta Meteorologica Sinica*, Peking, 30(1):28, Feb, **1959.** table. In Chinese; Russian summary p. 28. **DLC**—On Nov. 27, 1958 a cumulus cloud was produced at a 5600 m height over the earth's surface

with the aid of 18.3 kg of solid $CO_2$. The cloud lasted for 45 min. It was 7 km long and 1.3 km wide. *Subject Headings:* **1. Artificial cumulus cloud 2. Nanking, China.**—*A.M.P.*

**11M–969** 551.509.617(510)

**Opytnyĭ doklad o iskusstvennom padenii dozhdia v gorode Khan'kou.** [Report on artificial precipitation experiments at Hankow.] *Acta Meteorologica Sinica*, Peking, 30(1):29–34, Feb. **1959.** table. In Chinese; Russian summary p. 34. **DLC**—Six experiments of artificial rainfall from a warm cloud with the aid of solid $CO_2$ and salt water were carried out. It was found that solid $CO_2$ is more effective than salt water. Experiments of producing artificial precipitation with the aid of natural ice powder and salt were also carried out. *Subject Headings:* **1. Cloud seeding in China 2. Hankow, China.**—*A.M.P.*

**11M–970** 551.509.615/6(510)

**Opytnyĭ doklad o iskusstvennom unichtozhenni oblak i tumanov v provintsii Khebei,** [Report on experiments on artificial suppression of clouds and fog in Hopen Province]. *Acta Meteorologica Sinica*, Peking, 30(1):35–38, Feb. **1959.** table. In Chinese; Russian summary p. 38. **DLC**—Five experiments of artificial suppression of clouds and fog with the aid of a solid $CO_2$ and salt water with good results were carried out in Khebei Province. *Subject Headings:* **1. Artificial cloud modification 2. Artificial fog dissipation 3. Khebei Province, China.**—*A.M.P.*

**11M–971** 551.509.615:546.57:546.15

**Opytnyĭ doklad o iskusstvennom padenii dozhdia s pomoshch'iu AgI v Raione Siao-u-tai-san'.** [Report on artificial precipitation experiment with the AgI in Hsiao-wu-t'ai-san region.] *Acta Meteorologica Sinica*, Peking, 30(1):39–44, Feb. **1959.** 5 figs., (incl. photo), table, ref. in Chinese; Russian summary, p. 44. **DLC**—This is a report on a successful elimination of fog with the aid of AgI. During the experiment the AgI was not dissolved in $CH_3COCH_3$ (acetone) but directly ignited. *Subject Headings:* **1. Silver iodide fog dissipation 2. Cloud seeding with silver iodide 3. Siao-u-tai-san, China.**—*A.M.P.*

**11M–972** 551.509.324.2:551.578.7 551.509.617:551.578.7(510)

**Opytnyĭ vyvod unichtozheniia i prognoza grada v uezde Khao-Tsin v provintsii Iun'nan'.** [Experimental results in the suppression and forecasting of hail in Hao-Ch'ing District in Yunnan Province.] *Acta Meteorologica Sinica*, Peking, 30(1):1–4, Feb. **1959.** photo. In Chinese; Russian summary p. 4. **DLC**—A successful experiment of a short-range forecasting of an approaching thunderstorm and of its elimination by means of artillery shelling is reported. *Subject Headings:* **1. Hailstorm forecasting 2. Hail prevention in China 3. Yunnan Province, China.**—*A.M.P.*

**11M–973** 551.509.61(252)

**Les Physiciens de l'atmosphère parviendront-ils à inverser le processus de désertification du Sahara?** [Will the physicists of the atmosphere succeed in reversing the drying-up process in the Sahara?] *La Technique de l'Eau*, Brussels, 13(150):45–47, June **1959. NN, ICJ**—Summary and comments of a conference by H. DESSENS on April 9, 1959 at the Saharian Medico-social Information Days. Two methods are nowadays recommended in order to try to alter weather and to provoke rain: modification of weather through cloud seedings and energetic action on the forming and evolution of clouds. Two types of cloud seeding are mentioned, and energetic action on the forming and evolution of clouds is investigated. Seedings techniques seem to be ineffective in the Sahara. Artificial convection holds some hope (solar overheating or combustion). Experiments carried out by H. DESSENS in the Belgian Congo have proved the possibility of obtaining rain from large cumuli artificially formed in a clear sky. H. DESSENS is of the opinion that, with sufficient means at their disposal, it is just possible that the physicists of the atmosphere may succeed in reversing the desertification process in the Sahara. (*Same item as* 11.9–234, Sept. 1960, *Met. Abs.*) *Subject Headings:* **1. Cloud seeding 2. Artificial convective cloud generation 3. Sahara Desert. I. Dessens, H.**—*A.V.*

**11M–974** 551.509.6(73)

**Weather modification in the United States.** *Nature*, London, 183(4672):1371–1372, May 16, **1959. DWB**—The National Science Foundation will distribute $1,130,000 as follows for scientific studies of various aspects of weather control: $114,300 to Univ. of Chicago, Dept. of Met. (H. B. BYERS and R. BRAHAM) for research on physical effects of silver iodide seeding over the Great Plains; $161,800 to Univ. of Arizona Inst. of Atmos. Phys. (A. R. KASSANDER, L. J. BATTAN and J. E. MCDONALD) for research on cloud physics and cloud modification; $90,500 to Aerometric Research Inc., Goleta, Calif. (R. D. ELLIOTT) for research on precipitation process and efficiency of Pacific coast storms; $68,900 to U. S. Weather Bureau (D. B. KLINE) for synoptic observations and

studies of freezing nuclei anomalies; $57,100 to the Atmospheric Research Group of Pasadena, Cal for field studies in cloud physics related to nucleation, hydrometer development, electrification ar cloud dynamics; $50,000 to U. S. Office of Naval Research (B. VONNEGUT) for cloud electrificatio studies (by A. D. Little, Inc.); $40,000 to Met. Research Inc. (P. MACCREADY) for 2-year clou physics (radar) studies at Santa Barbara; $383,700 to Univ. of Chicago, Dept. of Met. (H. B. BYER for 3-year research into cloud physics and precipitation mechanisms: particles, nuclei, ice crystal water drops; $64,900 to Univ. of Calif., Statistical lab. (J. NEYMAN) for a 2-year study on randomize cloud seeding at Santa Barbara and Ventura counties; $58,800 to N. Y. U., Dept. of Math. (M. WOODBURY) for a 2-year study of statistical evaluation of weather modification; $25,000 to A.G. for a **Conference on Mechanism of Precipitation Formation**; $10,000 for a **Conference on Desig and Conduct of Research Programmes in Weather Modification** by the National Academy Sciences-National Research Council (S. S. WILKS); $5,100 for a **Conference on Instrumentation f Cloud and Weather Modification** by the Foundation for Instrumentation Education and Researc (*Same item as* 12.1 262, May 16, 1959, *Met Abs.*) *Subject Headings:* **1. Weather modificatio research 2. United States.**—*W.N.*

## 1960

**11M–975** 551.575.1:536.421:532.78:546.57:546.

Balabanova, V. N., **Kristallizatsiia pereokhlazhdennykh tumanov iodistym serebrom.** [Cry tallization of supercooled fog by silver iodide.] *Akademiia Nauk SSR, Izvestiia, Ser. Geofiz,* N 11:1658–1662, Nov. **1960.** 4 figs., 4 tables, 3 refs. Russian summary p. 1658. Transl. in English in the corresponding number of its *Bulletin of the Academy of Sciences, USSR, Geophysi Series.* **DLC**—Artificial crystallization of supercooled fog and clouds is produced by certain r agents that accelerate or slow their dissipation. One of the reagents is silver iodide. Tests we made to investigate the conditions of application of silver iodide or similar substances. The metho and the instruments used are described in detail and illustrated. It is found that the amount of i crystals increases with the amount of reagent introduced, but only to a certain limit, and upo reaching it, the amount of ice crystals stays practically constant. The relation between the numb of crystals and time is expressed by an exponential curve. It is presumed that ice crystals in fog a formed by the collision of water drops with particles of silver iodide. *Subject Headings:* **1. Supe cooled fog 2. Silver iodide fog seeding.**—*B.J.C.*

**11M–976** 551.574.2:551.576.1:551.588

Battan, Louis J. and Kassander, A. Richard, Jr. (*both, Inst. Atmos. Physics, Univ. Arizona*) **Artificial nucleation of orographic cumulus clouds.** *American Geophysical Union, Geophysic Monograph,* No. 5:409–411, **1960.** fig. **DWB, DLC**—A brief summary is given of the results randomized cloud seeding experiments carried out during two summer seasons. Orographic Cumu were seeded with an airborne AgI generator. The results to date have suggested that seedi causes important changes in the physical processes involved. It is planned to continue the exper ments. *Subject Headings:* **1. Orographic cumulus clouds 2. Cloud seeding experiments 3. Clou study—Santa Catalina Mountains 4. Rainfall data comparisons 5. Artificial nucleation 6. Ligh ning 7. Arizona University.**—*Authors' abstract.*

**11M–977** 551.509.617(79

Battan, Louis J. and Kassander, A. Richard, Jr. (*both, Univ. of Arizona*), **Design of a progra of randomized seeding of orographic cumuli.** *Journal of Meteorology,* Boston, 17(6):583–59 Dec. **1960.** 6 figs., table, 8 refs. **DWB, DLC**—From studies of the properties of convective clou over the mountains of southeastern Arizona, it was found that many failed to precipitate even thou they were supercooled and were quite deep. A carefully controlled cloud-seeding program w designed in 1957 and has been in progress for three years. This article discusses the experiment design and the observational techniques and gives some preliminary results. Since the researc has two more years to run, statistical evaluations are not given in this article. *Subject Heading* **1. Cloud seeding projects 2. Cloud seeding evaluation 3. Arizona.**—*Authors' abstract.*

**11M–978** 551.515.2:551.574.2:551.509.617:546.57:546.

Braham, Roscoe R., Jr. (*ed.*), **Hurricane cloud physics research.** Chicago. Univ. Dept. Meteorology, Contract Cwb-9175 and Contract Cwb-9484, Final Report, June 15, **1960.** 152 numerous figs., tables, refs., eqs. **DWB**—In this extensively illustrated report a study of certa microphysical aspects of hurricanes during the period July 1, 1957 through June 30, 1959 is presente The text is organized into eight sections. The section following the introduction is devoted to description of an airborne silver iodide generator for seeding large scale weather patterns. Sectio III reports an exploratory experiment in hurricane seeding. In the next section liquid-wate content measurements in hurricanes are reported. Section V is a report of precipitation partic

measurements in trade wind cumuli. Precipitation particle distribution in tropical storms, 1958 are given in section VI. Next in Section VII a cloud census of fair weather cumuli is reported. The final section describes movements of radar echoes in the eye wall of hurricane Daisy. *Subject Headings:* **1. Hurricane studies 2. Cloud physics research 3. Silver iodide smoke generators 4. Cloud seeding from airplane.**—*I.S.*

**11M–979** 551.509.617:551.521.11:551.574.2:532.78

Bryant, G. W. and Mason, B. J. (*both, Imperial College, London*), **Photolytic de-activation of silver iodide as an ice-forming nucleus.** *Royal Meteorological Society, Quarterly Journal*, 86(369): 354–357, July **1960.** 3 figs., table, 11 refs. **DWB, DLC**—The rate at which the ice-nucleating ability of silver iodide decays, when irradiated with the equivalent of strong sunlight, has been determined by measuring the density of oriented ice crystals appearing on single crystals of silver iodide after various periods of exposure to a mercury-arc lamp. Wavelengths greater than 4.400 Å cause very little photolysis and decay of nucleation. The ice-crystal density decreases 10- to 20-fold after the silver iodide has been exposed to the equivalent of one hour's strong sunlight; this result is in fair agreement with the findings of the Australian workers where the activity of silver-iodide smoke falls by 1 to 2 orders of magnitude after one hour in the atmosphere in sunlight. *Subject Headings:* **1. Silver iodide decay rate 2. Ice nucleation 3. Ice nucleation decay 4. Weather modification tests.**—*Authors' abstract.*

**11M–980** 551.509.617(794)

*California. Dept. of Water Resources, **Santa Barbara weather modification project: interim report of the Board of Directors.** Prepared as joint effort by North American Weather Consultants; Statistical Lab., Univ. of California; Meteorology Research, Inc.; and the California Dept. of Water Resources. Feb. **1960.** Each section repaged. Numerous plates (maps and graphs), tables. **DWB** (MO9.6 C153sa)—The results of three years of operations beginning with January 1957 are reported, including project history and design; cloud seeding operations; precipitation data collection program; evaluation of seeding operations; and physical studies of Santa Barbara storms. The tables present classification of raingages; of units of observation; simultaneous average precipitation in target and comparison area; effects of cloud seeding; probability of obtaining 5% result; number of corrections to forecast. The appendices deal with hours of generator operations; seeded days per season; application of statistical methods to the study of meteorological phenomena. Illustrated are the effect of generators; generators and windscreen; raingage installation; precipitation initiation model; relief map of Santa Barbara; radar dome on Forest Service Lookout, La Cumbre Peak; location of generators and hours of operation; summary of wind conditions; tracks of seedable storms; location of recording rain gages; comparison of target and control precipitation; finally plates of various storms and of raindrop size studies. *Subject Headings:* **1. Cloud seeding projects 2. Santa Barbara California. I. North American Weather Consultants II. Meteorology Research, Inc. III. California Univ.**—*O.T.*

**11M–981** 551.524.7:551.576.1:532.78

Chuvaev, A. P., **Temperaturnye granitsy nachal'noĭ kristallizatallizatsii oblakov.** [Temperature limits of initial cloud crystallization.] *Meteorologiia i Gidrologiia*, Leningrad, No. 3:26–28, March **1960.** fig., table, 8 refs. **DWB, DLC**—In studying the mechanism of the formation of natural precipitation and especially in the study of conditions favorable to artificial stimulation of precipitation from convective clouds it is important to establish the initial crystallization of supercooled tops of convective clouds. In previous papers the author described the temperature characteristics at the level of the upper boundary of cumulus congestus, on the basis of his observations in 57 zones of development of convective clouds in the southern regions and 41 zones in the northwestern region of European USSR, which are reviewed in connection with his recent scientific research flight over Lake Sevan (Armenian Republic). In view of the lack of instrumental observation of the water particles in the clouds in solid phase, the visual appearance of fibrous structure in the cloud tops is accepted as the initial process of crystallization. The observed data are tabulated analyzed graphically. All data indicate very sharp divisions of the temperature limits for the initial crystallization of the heavy cumulus clouds in various physico-geographic regions. *Subject Headings:* **1. Supercooled clouds.**—*N.P.S.*

**11M–982** 551.509.617(263)

Compañia Mexicana de Luz y Fuerza Motriz, S. A., **Operaciones de estimulación de lluvia en las cuencas de Necaxa y Lerma: informe anual, 1959.** [Operation of artificial stimulation of rain in the basins of the Necaxa and Lerma Rivers: annual report 1959.] Issued Jan. **1960.** 16 p. (looseleaf) numerous charts, refs. **DWB** (MO9.67 C737op)—Further comparisons (*see* 11M–491) are made of precipitation amounts in the Necaxa basin (near 20°N, 98°W), where silver iodide seeding operations have been conducted since 1949, and in a control zone about 50 miles to the south-

east. It was earlier determined, on the basis of 35 years of data, that precipitation amounts in th two regions, both equally sensitive to trade flow from the Gulf of Mexico, correlate ver well ($R = 0.96$). In this report, a series of graphs is presented showing relative accumulated precipita tion amounts (June–Oct.) in the control zone versus the seeded zone, first in the 15 years before 194 and then in the years when seeding took place. Separate curves are drawn for rainfalls of differen amounts, 0–19, 20–49, and $\geqq 50$ mm. The graphs demonstrated that seeding has been clearl effective in the case of slight to moderate rainfalls, but ineffective or actually unfavorable in the cas of heavy rainfalls. In the Lerma basin, where seeding operations have been conducted for 4 year conclusive results have not yet been obtained. It is believed the network of generators is sti insufficient. Also, the relatively complex meteorological exposure of this region, with flow from bot the Gulf of Mexico and the Pacific, will make it difficult to evaluate the precipitation data obtaine *Subject Headings:* **1. Cloud seeding in Mexico 2. Cloud seeding effectiveness 3. Gulf of Mexic** —*R.S.Q.*

**11M–983** 551.509.615:656.7:547.21

Cot, P. D. and Serpolay, R., **Etude de divers procédés tendant à l'atténuation du brouillar** [Study of various methods aiming at the attenuation of fog.] *Académie des Sciences, Paris, Compt Rendus*, 250(20):3277–3279, May 16, **1960.** 3 figs., 2 refs. **DWB, DLC**—Description of exper ments made with a view to reduce the denseness of fogs on airfields and statement of their result There are two types of fogs: supercooled fogs and fogs with a positive temperature. In the firs case, under the action of a liquefied gas expansion (generally propane) the supercooled droplets o fog are transformed into ice crystals. This transformation provokes a marked decrease of th optical density and thus an increase in visibility. The transformation of supercooled fogs into ic crystal fogs is possible if the cloud temperature is less than $-1°C$ or even $-0.5°C$. In the case o fogs with positive temperature one has utilized the thermal energy produced by the great speed an high temperature exhaust fumes of a jet-engine aircraft. Through this process, one can obtain marked improvement of the visibility over a horizontal distance of 200 m, and 20 to 30 m in altitud *Subject Headings:* **1. Artificial fog dissipation 2. Propane expansion.**—*A.V.*

**11M–984** 551.509.616/61

†Demortier, G., **La pluie artificielle.** [Artificial rain.] *Revue de l'Agriculture*, Brussels, 13(3) 299–340, March **1960.** 3 figs., bibliog. p. 330–340. **DA**—Very inclusive survey, intended fo agricultural experts, of the experiments and investigations made in the field of artificial rain. Afte a short introduction, the author recalls the principal notions relating to water in the atmosphere an to clouds. He mentions the origin of the seeding processes used for obtaining artificial rain an exposes the theories on the formation of atmospheric precipitation. The principal substances use to provoke artificial rain and the seeding techniques are reviewed. Among the substances used i cloud seedings, the author examines the properties of large water drops, common ice (in morsels) dry ice, silver iodide, sodium chloride and bay-salt. The article deals further with some phenomen observed in aqueous precipitation, and the statistical study of the results of seeding tests made for long period. Conclusions concerning cloud seeding techniques are summarized at the end of th article. The appendix contains some considerations on the drought which occurred in Belgiu during 1959. It is shown that cloud seedings, even when made on a large scale, have little chance t remedy the effects of drought periods in this country. *Subject Headings:* **1. Artificial precipitatio 2. Cloud seeding effects 3. Cloud seeding effectiveness.**—*A.V.*

**11M–985** 551.509.616:551.574.

Dessens, Henri (*Observ. Puy de Dôme, Clermont-Ferrand, France*), **A project for a formation c cumulonimbus by artificial convection.** *American Geophysical Union, Geophysical Monograph* No. 5:396–401, **1960.** fig., 8 refs. **DWB, DLC**—Research on weather control should not be re stricted to the nucleation of clouds. The convection process plays an eminent part in the formation c precipitation. After several experiments with great brush fires, an experimental installation capabl of modifying the local system of convection sufficiently to produce rain has been planned. Thi installation called 'meteotron' will consist of a pump serving 100 burners with fuel oil, so that th total consumption will be of the order of one ton per minute. The results of the experiments wit great brush fires indicate that the formation of artificial thunderstorms will probably be obtaine at least in equatorial regions, by working with the meteotron. *Subject Headings:* **1. Artificial cumulo nimbus formation 2. Artificial convection 3. Brush fire cloud formation 4. Meteotron.**—*Author' abstract.*

**11M–986** 551.509.6:061.1(73

Droessler, Earl G. (*Natl. Science Foundation, Wash., D. C.*), **The present status and the promis of weather modification.** *American Geophysical Union, Transactions*, 41(1):26–34, March **1960** 7 refs. **DWB, DLC**—A descriptive paper summarizing the activities and effort to modify the weathe

First, a historical sketch of the activities, mainly those connected with clouds and precipitation, is presented. Then mention is made of the investigations and reports of the Advisory Committee on Weather Control created by the Congress in 1953. This is followed by a description of the weather modification program of the National Science Foundation. Finally, prospects of weather control in the future are discussed. It is concluded that large scale weather-control measures should be attained within the next 20 years. An appendix describing the National Science Foundation Research Program on weather modification follows the paper. *Subject Headings:* **1. Progress in weather control 2. Cloud modification projects 3. U. S. National Science Foundation.**—*I.S.*

**11M–987** 551.574.2

Edwards, G. R. and Evans, L. F. (*Commonwealth Scient. and Industrial Res. Org., Melbourne*), **Ice nucleation by silver iodide, Pt. 1, Freezing vs. sublimation.** *Journal of Meteorology*, Boston, 17(6):627-634, Dec. **1960.** 8 figs., 19 refs. **DWB, DLC**—The ability of silver-iodide particles to act as ice nuclei has been studied under controlled conditions of temperature and humidity. Particles up to 100 Å in radius are largely ineffective as ice nuclei unless the humidity, relative to water, exceeds 110 per cent. Consequently, in natural clouds where the relative humidity rarely exceeds 101 per cent, such particles will only be useful if they collide with cloud droplets. An apparatus has been developed which allows the number of ice nuclei in an aerosol to be counted with a probable error of less than 10 per cent. The particular advantage of this apparatus is its continuity of operation, which enables one to count either a rapid succession of aerosol samples or, if the fall-out is prolonged, to follow the variation of fall-out with time. The delayed appearance of ice crystals in a cold chamber is not due to a time lag in the nucleation process but to the time required for aerosol particles to collide with cloud droplets or to migrate to more humid regions of the cloud chamber where condensation can take place on each particle. The activity, as a freezing nucleus, of the silver iodide described herein is much greater than that found by previous authors, particles of radius 75 Å being active at −8C. *Subject Headings:* **1. Silver iodide nuclei 2. Ice nucleation.**—*Authors' abstract.*

**11M–988** 551.596.1:662.2:539.1

Eisele, L J. (*Spring Hill College*) and Gherzi, E. (*Brebeuf College*), **Atmospheric waves caused by a nuclear explosion.** *Bulletin de Géophysique*, Montreal, No. 7:3–11, March **1960.** table, 9 refs. **DWB.** French summary p. 8. **DWB**—Describes the atmospheric waves caused by a nuclear explosion in the Pacific Ocean. The ten megaton H-bomb was exploded in the Pacific on May 20, 1956. These waves which came in two trains were recorded at Mobile, Alabama. The mean speed of waves arriving by the shorter branch was equal to 304 m/s. According to researchers, the knowledge of atmospheric conditions is necessary for forecasting and speed of sound waves. The 16–17 minute interval between the two wave trains was due to the formation of giant mushroom clouds. *Subject Headings:* **1. Atmospheric waves 2. Nuclear explosion effects.**—*A.H.K.*

**11M–989** 551.509.617(468.5)

Garcia-Prieto, P. R. (*Spanish Weather Service*); Ludlam, F. H. and Saunders, P. M. (*both, Imperial College, London*), **The possibility of artificially increasing rainfall on Tenerife in the Canary Islands.** *Weather*, London, 15(2):39–81, Feb. **1960.** 4 figs., 3 tables. **DWB**—The relation of trade winds to the Azores anticyclones is described and their characteristics are summarized in a table. The variations of the vertical thickness of the orographic cumulus observed at Izaña and the number of days per month with altitudes of 1000, 1300 and 1500 m is shown by diagrams. From the comparison of the size of cloud droplets at Tenerife and the Hawaiian Islands the difficulty of obtaining an increase of precipitation in this region of the Canary Islands is derived. Salt nuclei measurements and rain drop measurements are also summarized in tables. A moderate trade wind flow in the afternoon is illustrated by a North-South profile for Tenerife. *Subject Headings:* **1. Cloud seeding potentialities 2. Tenerife, Canary Islands.**—*O.T.*

**11M–990** 551.509.68:550.3:662.2:539.1

Hinzpeter, Max, **Kernwaffenversuche und atmosphärische Vorgänge.** [Nuclear weapon tests and atmospheric processes.] *Naturwissenschaftliche Rundschau*, Stuttgart, 13(4):126–130, April **1960.** 4 figs., 9 refs. **DWB, DLC**—The effect of released energy and of the presence of nuclear debris up to 30 km on atmospheric conditions is analyzed. The period of presence of aerosols in the troposphere amounts, in most cases, to less than 30 days following a nuclear weapon explosion. An atomic explosion represents only a point effect related to the whole Earth's surface. The amount of heat released by a typical thundercloud is comparable to the energy produced by 13 normal atomic bombs of 20,000 t explosive energy each. Nuclear weapon tests cannot affect the heat economy of the atmosphere and weather phenomena controlled by it. The genetic history of a raindrop reaching the earth's surface shows no effect from nuclear debris. The observed increase of tornadoes since 1950 can be explained by the refinement of the observation technique. None of the very heavy

tornadoes of 1953 were observed in regions of atomic clouds or of strong radioactive fallout. From 1950, when bomb tests in Nevada began, to 1955, precipitation reached only 75% of normal. An increase of conductivity in the atmospheric electricity field by radioactive fallout was occasionally observed near the surface; it does, however, not occur at higher altitudes dominated by the ionization effect of cosmic radiation. A connection between nuclear weapon tests and atmospheric processes has not yet been ascertained. All estimates show the negligibility of the effects of nuclear weapon tests. Short and limited variations of the earth's magnetic field were observed during nuclear weapon tests in the Pacific. *Subject Heading:* **1. Nuclear explosion effects.**—*O.T.*

**11M–991** 551.509.617

†Howell, Wallace E. (*Lexington, Mass.*), **Cloud seeding in the American tropics.** *American Geophysical Union, Geophysical Monographs*, No. 5:412–423, **1960.** 6 figs., 2 tables, 20 refs. **DWB, DLC**—Cloud-seeding projects that have been carried out in the American tropics are described, and evaluations of the results are summarized and discussed in the light of existing models of precipitation formation. A new model based on a field of competition in which convective clouds is proposed and discussed to explain the effectiveness of seeding under weather conditions where clouds develop relatively slowly toward the precipitating stage. *Subject Headings:* **1. Cloud seeding studies 2. Precipitation formation models 3. Cloud seeding in American Tropics 4. Cloud development models 5. Isohyetal map of rainfall 6. Hodograph of winds aloft 7. Tropical cloud descriptions.**—*Author's abstract.*

**11M–992** 551.509.617(213)

†Howell, Wallace E., **Seeding of clouds in tropical climates.** *American Society of Civil Engineers, Irrigation and Drainage Div., Journal*, 86(Paper 2397):55–77, March **1960.** 3 figs., 4 tables, 77 refs. **DLC**—The more important attempts of cloud seeding carried out in the tropics during the period 1948–1958 are summarized. In these experiments cloud seeding was carried out either by introducing water spray or hygroscopic particles into warm clouds so as to stimulate rain by the coalescence process or by seeding supercooled clouds with dry ice or silver iodide in order to stimulate precipitation by sublimation. The experiments show that seeding with spray or hygroscopic particles often dissipates small warm clouds but also stimulates convective activity and initiates or increases rainfall from clouds whose depth exceeds 4000 ft. Seeding of supercooled clouds with dry ice or silver iodide seems to produce a smaller but still considerable increase in precipitation. The experiments indicate that theory and observation are in substantial agreement regarding the initiation of rainfall by a coalescence process in warm clouds and regarding the influence of salt or water seeding upon rainfall initiation. In order to explain the rain inducing action of silver iodide or ice crystals the author proposes a new model of convective cloud fields within which a number of convective cells compete for potential energy, slowly warming and deepening the surface as they increase gradually in size and decrease in number. By means of this model it is possible to describe "the approach of individual clouds to the rain stage in terms of the accumulated growth of rudimentary precipitation particles, that when it exceeds some critical limit, results in precipitation which, in turn stimulates activity in the first cloud to reach this stage and supresses it in other nearby clouds." Warm cloud seeding influences the model directly by increasing the supply of rudimentary precipitation particles; silver-iodide seeding acts indirectly by increasing both the rate of growth of rudimentary particle precipitation and the volume of cloud in which they may grow thereby acting upon the coalescence rather than through the sublimation processes." *Subject Headings:* **1. Cloud seeding with silver iodide 2. Cloud seeding in the tropics.**—*I.L.D.*

**11M–993** 551.509.616:551.576.1:778.38

Jefferson, G. J., **Man-made cumulus.** *Meteorological Magazine*, London, 89(1050):16–17, Jan **1960.** 5 photos. **DWB, DLC**—The occurrence of cumulus and cumulonimbus over the Goldenburg Power Station at Knapsack, Cologne, Germany, is described. A photograph taken in May 1957 of a cumulus cloud is shown. Three cumulus towers in various stages of growth are visible in the photograph. The synoptic situation on the same day is also described. The height of the cumulus tops obtained by the use of simple photogrammetric methods is reported. The clouds in the photograph, reportedly, did not give showers while still within visual range. (*Same item as* 12.1–263 Jan. 1960, *Met. Abs.*) *Subject Headings:* **1. Cumulonimbus clouds 2. Artificial clouds 3. Cloud photogrammetry.**—*I.S.*

**11M–994** 551.508.91:551.574.2:551.578.41

Katz, Ulrich (*Zürich*), **Zur Eiskeimbildungsfähigkeit von Kupferoxyden und Kupfersulfiden** [Icing nucleability of copper oxides and copper sulfides.] *Zeitschrift für Angewandte Mathematik und Physik*, Basel, 11(3):237–244, **1960.** 5 figs., 13 refs. **DLC**—The icing nucleability of $Cu_2O$, CuO, $Cu_2S$, $Cu_2S_5$, and CuS has been measured as a function of the temperature. After a short description of the way in which the substances were prepared, the measuring apparatus is explained

Fig. 1 shows the cloud chamber with a particularly small temperature gradient and the apparatus with which a supercooled cloud is first produced in the chamber, before the seeding substance from the disperser (Fig. 2) is injected into the cloud by means of the dosage instrument. The fallout of ice crystals is observed visually and their number estimated. The concentration of the seeding particles is obtained through a sedimentation tube (Fig. 2). The size distribution of the particles is represented in Fig. 3, and it should be noted that no diameter of less than 0.5$\mu$ occurs. Figs. 4 and 5 show the activity in terms of icing nucleability 2, which is defined as the ratio of observed ice crystals to the number of nuclei injected into the cloud. A brief comparison is made of these measurements with the theory of FLETCHER concerning the dependence of particle size on the threshold temperature, and with the experiments of other authors. The only explanation attempted of the differences which have been established here has been for the time being in qualitative terms. The threshold temperatures of the substances in question are (±0.5°C), $Cu_2O$: −4.2°C, CuO: −13.5°C, CuS: −5.1°C, $Cu_9S_5$: −5.7°C, $Cu_2S$: −6.4°C. *Subject Headings:* **1. Icing nucleability 2. Nuclei instruments 3. Artificial nuclei production.**—*Author's abstract.*

**11M–995** 551.574.2:546.57:546.15

Koenig, L. Randall (*Univ. Chicago*), **The chemical identification of silver-iodide ice nuclei: a laboratory and preliminary field study.** *Journal of Meteorology*, Boston, 17(4):426 434, Aug. **1960.** 10 figs., 12 refs. **DWB, DLC**—The technique and results of the application of a chemical test, explicitly for silver iodide, sensitive to a mass of $3\times10^{-17}$ g, to laboratory-nucleated ice crystals and atmospheric ice crystals from cloud-seeding experiments in the field are described. In laboratory ice crystals, it was found that the silver-iodide nucleus was not always in the apparent "C" axis of the ice crystals. This deviation is discussed. Because of difficulties in the preservation of the ice crystals from the field experimentation, no evidence of the true role of silver iodide in cloud seeding was obtained. (*Same item as* 12.6–379, Aug. 1960, *Met. Abs.*) *Subject Heading:* **1. Silver iodide nucleation.**—*Author's abstract.*

**11M–996,** 551.574.2:551.508.91:541.18

Krasikov P. N., **O primenenii kolloidnykh rastvorov dlia vozdeĭstviia na pereokhlazhdennye oblaka i tumany.** [Using colloid solutions for artificial action on supercooled clouds and fogs.] *Leningrad. Glavnaia Geofizicheskaia Observatoriia, Trudy*, No. 104:75–78, **1960.** 6 refs. Russian summary p. 75. **DWB**—The results of laboratory experiments on the influence of colloidal solutions of AgI on the formation of ice particles in a supercooled cloud are examined. The colloidal solution was obtained by mixing aqueous solutions of silver nitrate and dissolved salts containing iodine (for example $NH_4I$, KI, NaI); the concentration of the solutions varied from 0.02 to 0.2y AgI. The experiments were carried out in a vessel with a capacity of 250 l. The colloidal solutions were dispersed in the cloud at a temperature from −20 to −2°C by a pulverizer in an amount of 0.5–1.0 g. It was established that at a temperature of −20° to −7°C the fog crystallized completely; at higher temperatures there is a partial formation of ice crystals. *Subject Headings:* **1. Cloud seeding techniques 2. Silver iodide diffusion 3. Cloud chamber experiments 4. Colloids.**—*I.L.D.*

**11M–997** 551.509.61:061.1(73)

Kvam, Ernest L., **Evolution of the U. S. Weather Bureau in meeting the needs of radically changing times.** June **1960.** 126 p. 8 figs., numerous foot-refs., 63 refs. (in bibliog.). Thesis (M.A.)—George Washington Univ., Wash., D. C. **DWB** (M:350 K97ev)—IV. Weather modification and control, p. 76–92. The history and current status of weather modification in the United States is described with its impact on the legislative functions of the Weather Bureau. The controversy between theory and practice started in the late eighteen hundreds, and has included hail prevention and fog dispersal since the first quarter of the twentieth century. VERAART, BERGERON and FINDEISEN were chiefly responsible for providing a scientific basis for rainmaking by their theories. The Weather Bureau was unwilling to admit any definitive results during this early period from 1890 to 1940, emphasizing the need for further scientific research. Modern schemes are based on discoveries of LANGMUIR and SCHAEFER in 1946. Legislation on rainmaking started with Senate Committee Hearings in 1951. Project Cirrus proved the effectiveness of seeding cumulus clouds. The Advisory Committee on Weather Control, established in 1953, submitted on December 31, 1957, its final report. The national Science Foundation was charged with a research program in weather modification in 1958. Three major conferences or workshops were sponsored and several contracts and grants were awarded by the Foundation in 1959. (For abstract on whole thesis *see* 12.6–82, June 1961, *Met. Abs.*) *Subject Headings:* **1. U. S. Weather Bureau 2. Weather control in U. S. 3. Cloud seeding in United States.**—*O.T.*

**11M–998** 551.509.615:546.57:546.15

Müller, Hans Gerhard (*Aerological Station, Munich*), **Impfversuche mit Silberjodid in unterkühltem Nebel.** [Seeding experiments with silver iodide in supercooled fog.] *Beiträge zur Physik*

*der Atmosphäre*, Frankfurt a.M., 33(1/2):1–8, **1960.** 4 figs. (3 color), 2 tables, 2 refs. German, English and French summaries p. 1. **DWB, DLC**—Two experiments are described which were made with a silver-iodide generator at the surface in supercooled fog. A comparison of the observations made during the experiments shows how the results depend on the temperature and wind stratification, on the thickness of the fog layer, and on the topography. The possibilities of weather modification are largely determined by these meteorological factors. *Subject Headings:* **1. Cloud seeding with silver iodide 2. Fog seeding experiments.**—*Author's abstract.*

**11M-999** 551.509.617:519.241.2(794)

Neyman, Jerzy; Scott, Elizabeth L. and Vasilevskis, Marija (*all, Univ. Calif.*), **Randomized cloud seeding in Santa Barbara.** *Science*, Wash., D. C., 131(3407):1073–1078, April 15, **1960.** 3 figs., 2 tables, 2 refs. **DLC**—The effectiveness of cloud seeding during a three year period is statistically evaluated. Both the normal theory and nonparametric methods of evaluation were made. Ventura county was included in the project and the effects of seeding on rainfall in Ventura were generally statistically nonsignificant. Differences in precip. from seeded and from nonseeded clouds as observed in Santa Barbara appeared to be significant. *Subject Headings:* **1. Cloud seeding experiments 2. Statistical analysis of artificial precipitation 3. Santa Barbara, Calif.**—*E.Z.S.*

**11M-1000** 551.509.617:519.241.2(794)

Neyman, Jerzy; Scott, Elizabeth L. and Vasilevskis, Marija (all, Univ. Calif.), **Statistical evaluation of the Santa Barbara randomized cloud-seeding experiment.** *American Meteorological Society, Bulletin*, 41(10):531–547, Oct. **1960.** 4 figs., 3 tables, 11 refs. **DWB, DLC**—The experimental conditions of the Santa Barbara Project over the three years 1957 through 1959 were not uniform. In 1957, there was no seeding in the adjoining areas. In 1958, seeding went on in Ventura County at every opportunity. In 1959, the seeding operations in the two counties were factorially randomized. These changes created partial confounding of possible effects of seeding with possible effects of changes in weather pattern. Whatever the cause, some of the apparent effects were very large. In particular, the average apparent increase in the rain in Santa Barbara obtained in the absence of seeding in Ventura, amounted to about 100 per cent. The last section of the paper is concerned with recommended changes in the design intended to increase the accuracy of the experiment. *Subject Headings:* **1. Cloud seeding experiments 2. Statistical analysis of artificial precipitation 3. Santa Barbara, Calif.**—*Author's abstract.*

**11M-1001** 551.509.617:551.578.7(45)

Nikandrov, V. Ia., **Bor'ba protiv gradobitiĭ, v Italii.** (Hail control in Italy.) *Meteorologiia i Gidrologiia*, Moscow, No. 4:51–52, April **1960.** fig. **DWB, DLC**—The development of hail prevention in Northern Italy since 1949 under the auspices of the Ministry of Agriculture, and the establishment of a network of rocket installations covering 500 km² and involving 8000 farms is discussed. The extensive international research program on hail formation and prevention carried out in Northern Italy in 1958 is described; the participants, means of observation and procedure are given. As a result of their work on hail prevention Italian investigators accept the theory of FRANK LUDLAM. This theory maintains that hail formation takes place in the lower layers of hail clouds. Hence the use of rockets exploding at 1—1.5 km above the surface of the earth is valid; from this level the reagent particles rise farther as a result of natural processes in convective clouds and drop forming rather than ice forming agents are more effective. Particles of ordinary table salt having a mass of one billionth of a gram can produce droplets 30$\mu$ in diameter within a few minutes after introduction into the appropriate cloud layer. It is calculated that during the explosion of a single rocket some 30 billions of minute hygroscopic particles, around which water droplets are formed, are released. This prevents the coagulation of small drops into large drops and hence the formation of large hail stones. *Subject Headings:* **1. Hail prevention in Italy 2. Hail rockets 3. Italy.**—*I.L.D.*

**11M-1002** 551.574.1:061.6 551.509.6:061.6

Orville, Howard T. (*V. P. Beckman & Whitley, Inc.*, San Carlos, Calif.), **Future research in weather modification.** *American Geophysical Union, Geophysical Monograph*, No. 5:384–387, **1960.** 9 refs. **DWB, DLC**—The paper outlines the present status of research in cloud physics and weather modification, and attempts to emphasize the need for expanded research in certain areas of cloud physics. Several suggested outlines for research projects are given. *Subject Headings:* **1. Cloud physics research 2. Weather modification research.**—*Author's abstract.*

**11M-1003** 551.509.617:551.574.2(52)

Ōta, Y. et al., **Notes on artificial rainfall experiments at the top of Mt. Fuji in winters from 1955 to 1957.** *Journal of Meteorological Research*, Tokyo, 12(4):253–259, April **1960.** 6 tables. In Japanese. **DWB, DLC**—Artificial rainfall experiments at the top of Mt. Fuji were carried out from Nov. 1955 to March 1957 using an acetone solution of silver iodide burned at 700–800°C. Three

tables show the result of the experiment on the rainfall frequency as well as seeding frequency, smoking hours, amount of acetone used (1/hr), wind direction and speed, and rainfall amount. It is concluded that the increase of ice crystal nuclei was dependent on the condition of air currents, and that it was three or four times higher than on ordinary days (non-seeding day). *Subject Headings:* **1. Cloud seeding in Japan 2. Mt. Fuji, Japan.**—*K.C.*

**11M–1004** 551.509.617(769)

Penrod, Estel B., **More talk about the weather.** *Kentucky Engineer*, Lexington, 22(3), March **1960.** Reprint of 5 p. 4 figs., 4 refs., 7 eqs. **DWB** (MO9.617 P417mo)—The serious difficulties and problems involved in having "controlled weather" are discussed. Controlling weather means to be able to heat or cool, humidify or dehumidify the air adjacent to the ground and to produce rains to prevent droughts. To illustrate the problems involved in this an engineering analysis is made of a specific case. The quantity of water required and the solar energy utilized to evaporate the water and to elevate it to a height of one mile above sea level in order to have a one inch rainfall on the surface of Kentucky, are calculated. *Subject Headings:* **1. Weather control 2. Kentucky.**—*I.S.*

**11M–1005** 551.509.617:551.578.7

Sänger, Raymund (*Swiss Fed. Inst. Tech. Zurich, Switz.*), **The Swiss randomized hail suppression project in the Tessin.** *American Geophysical Union, Geophysical Monograph*, No. 5:388–395, **1960.** 6 figs., 2 refs. **DWB, DLC**—The first two years of the Swiss randomized antihail project does not yet allow any statement having statistical weight about the effect of the AgI seedings to prevent hail, neither in a positive, negative, nor indifferent sense. However, the precipitation patterns display indications for a strong increase of rain as a result of AgI seeding by ground generators. According to the general design the project will be carried on for a period of five years in the hope of arriving at some definite decisions as to the effects of silver iodide on hail formation. *Subject Headings:* **1. Hail prevention in Switzerland 2. Silver iodide effects on hail formation 3. Precipitation data 4. Kolmogorov-Smirnov test.**—*Author's abstract.*

**11M–1006** 551.578.7:551.509.617

Schaefer, Vincent J. (*State U. Coll. Ed. Albany, N. Y.*), **Hailstorms and hailstones of the Western Great Plains.** *Nubila*, Verona, 3(1):18–29, **1960.** 11 figs., 7 refs. Italian and English summaries p. 18. **DWB**—The characteristics of some of the worst hailstorms on record, which ravaged the region of Grand Island, Nebraska, on June 27, 1959, are described. Pictures show the hail damage to automobiles, aircraft, anemometers and some of the hail remaining on the ground next morning; radar echoes of raincells and their geographic relationship; position of low pressure; pressure, temperature, dewpoint and precipitation; and typical cross sections of hailstones. Properties of some hailstones were examined at the Loomis School at Windsor, Connecticut and the causes of such storms were discussed. Suggestions to modify the cloud seeding efforts performed in the vicinity of Scotts Bluff, Nebraska and Stirling, Colorado, for hail prevention, are presented. *Subject Headings:* **1. Hailstorms 2. Hail damage 3. Hail prevention 4. Grand Island, Nebraska.**—*O.T.*

**11M–1007** 551.577.38(773) 551.509.617

Semonin, Richard G. (*Ill. State Water Survey, Urbana*), **Artificial precipitation potential during dry periods in Illinois.** *American Geophysical Union, Geophysical Monograph*, No. 5:424–431, **1960.** 3 figs., table, 6 refs. **DWB, DLC**—The macroscale meteorological conditions of the atmosphere were studied during 31 dry periods which occurred in 1953–1955. A dry period is defined as at least five consecutive days with less than 10% of the normal precipitation over an area in east central Illinois. The parameters investigated, measured at Rantoul, Illinois, were: precipitable water, low cloudiness, and the Showalter stability index. The upper-air flow, surface temperature, and general synoptic conditions were considered in individual case studies. The results indicate that although there is near normal water vapor in the atmosphere during the majority of the dry periods, there was a deficit of low clouds. It is concluded from the study that in addition to present cloud seeding techniques, much research is needed to determine means of initiating clouds, since, during dry periods in Illinois, large quantities of clouds desired for seeding are not available. *Subject Headings:* **1. Dry periods in Illinois 2. Cloud seeding potentialities 3. Illinois.**—*Author's abstract.*

**11M–1008** 551.509.615:621.438:621.43.06

Serpolay, R., **Sur l'utilisation des gaz chauds d'échappement de turbo-réacteur pour dissiper les brouillards.** [Use of hot exhaust gases from a turbo-reactor for fog dissipation.] *Puy de Dôme. Observatoire, Bulletin*, Ser. 2, No. 2:47–52, April/June **1960.** 2 figs. **DLC**—The first part of this article reviews C. S. Downie and R. B. Smith's work: **Thermal techniques for dissipating fog from aircraft** (see 11M–867). The second part relates to experiments made at Paris airport by means of a turbo-reactor capable of producing 16.000 kW in the form of thermal energy. It describes the

material used and gives account of the observation and measurements. Excellent results may be obtained by this process to improve the horizontal visibility from soil level to a few meters above. The horizontal extension of the cleared air-tongue can reach the maximum extent of 175 to 200 m in length and 90 to 100 m in width. In oblique visibility and for a height up to 30 or 40 m increase in visibility cannot be expected. *Subject Headings:* **1. Fog dissipation by jet exhaust 2. Turbojet exhaust gases 3. Airport visibility improvement 4. Paris Airport.**—*A.V.*

**11M–1009** 551.509.615

Stewart, K. H., **Recent work on the artificial dispersal of fog.** *Meteorological Magazine*, London, 89(1,061):311–319, Dec. **1960.** 2 tables, 6 refs. **DWB, DLC**—After a brief historical introduction this paper reviews recent British experiments. FIDO is being developed by the Ministry of Aviation. Experiments are being carried out to find the heat distribution around a series of three parallel 900-yard burner lines. Work on the use of surface-active chemicals which was carried out in 1955 and 1958 by Battersea College was unrewarding and has now ceased. Experiments have recently been carried out on the spraying of hygroscopic chemicals. The results were inconclusive probably due to the inadequacy of the spraying equipment. The results of calculations on the growth of droplets and a discussion of the best hygroscopic material to use are given in an appendix to the paper. A discussion of American work is given based on papers at the "First fog research and modification planning session" held in Boston on Jan. 25 and 26, 1960. It is mainly concerned with the work carried out at Arcata California. French, Swiss and U. S. work on the seeding of ice fogs is noted. The three most promising methods for future development are 1) the thermal method, this method has already been proved but costs are an important factor; 2) the hygroscopic chemical method, the development of this method requires full-scale trials and 3) the electrically charged spray method, this method has many uncertainties but may turn out to be the cheapest method. The first stage in the study of this latter method must be a small-scale study of the collection process. *Subject Heading:* **1. Artificial fog dissipation.**—*R.B.*

**11M–1010** 551.509.617:551.501.777:551.577:519.241.1

Summers, Peter W. and Power, Bernard A. (*both, Weather Engineering Corp. of Canada, Quebec*), **The effect of cloud-seeding evaluation of errors in precipitation measurement due to the varying water equivalent of snow.** *American Meteorological Society, Bulletin*, 41(2):89–90, Feb. **1960.** 3 refs. **DWB**—A serious inconsistency was observed in the regression equation for the winter months, in the evaluation of the cloud seeding project in eastern Canada. The project was undertaken in western Quebec from Oct. 1955 to Nov. 1958, making a total of 28 months. The evaluation method consisted of a linear-regression analysis relating the normalized precipitation for 2 target stations with that at 12 control stations over a 21- to 24-year historical period. The results of analysis are discussed and tabulated. *Subject Headings:* **1. Cloud seeding evaluation 2. Statistical analysis of artificial precipitation.**—*I.S.*

**11M–1011** 551.578.7:551.509.617(494.5)

*Switzerland. Eidg. Kommission zum Studium der Hagelbildung und der Hagelabwehr, **Grossversuch III zur Bekämpfung des Hagels im Tessin, 3. Versuchsjahr.** [Project 3 for hail control in Ticino, third year of experiment.] Its *Tätigkeitsbericht*, No. 12, 1959, issued **1960.** 104 p. 6 figs., 39 tables. Mimeog. Italian, French and English summaries, p. i–ix. **DWB** (M78.7 S979g) ——(For earlier reports *see* 11M–657, –749, –830, –897 and –960). This report contains tabulated weather data for 1959 collected for Hail Suppression Project III in its third year. It appears that under weather conditions accompanied by air currents which are not conducive to the formation of natural rainfall, appreciable increase cannot be expected from silver iodide seeding of the atmosphere. The year 1959 was a comparatively dry year and did not yield any substantial contribution to the question of the effectiveness of silver iodide seeding. *Subject Headings:* **1. Hail prevention in Switzerland 2. Ticino, Switzerland.**—*E.Z.S.*

**11M–1012** 551.511:551.515:551.577.11

Todd, Clement J. (*Meteor. Res. Inc., Altadena, Calif.*), **Physics of precipitation in winter storms at Santa Barbara, California.** *American Geophysical Union, Geophysical Monograph*, No. 5:402–408, **1960.** 8 figs., 4 refs. **DWB, DLC**—The immediate purpose of the physical analysis of storms at Santa Barbara, is to increase the sensitivity of the statistical analysis, (a) by finding physical explanations of as much of the variability between target and control as possible, and (b) by finding physical methods of classifying which precipitation mechanisms are operating in order that the storm periods may be stratified according to a reasonable hypothesis of seedability for a statistical test. *Subject Headings:* **1. Winter storms at Santa Barbara, California 2. Precipitation physics 3. Precipitation mechanism 4. Rainfall data—Santa Barbara 5. Raindrop size distribution 6. Hourly rainfall averages 7. Convective storms.**—*Author's abstract.*

**11M–1013** 551.509.6(09)

U. S. National Science Foundation, **Weather modification. First Annual Report for fiscal year ended June 30, 1959.** Pub. **1960.** 16 p. Price $.35 from U. S. Govt. Print. Office. **DWB** (MO9.67 U585we)—This report reviews activities associated with weather modification by different agencies. The agency mainly responsible for government work on weather modification is the National Science Foundation. The program and work of the Foundation during 1959 is systematically surveyed. The weather modification activities of other Federal Government agencies and of non-federal agencies are also reviewed. *Subject Headings:* **1. Progress in weather control 2. U. S. Advisory Committee on Weather Control.**—*I.S.*

**11M–1014** 551.509.61:551.574.2:546.57:546.15

Zhigalovskaia, T. N. and Balabanova, V. N., **Izuchenie rasseianiia dyma ïodistogo serebra v zamknutom sosude.** [Study of the dissipation of AgI smoke in a closed vessel.] *Akademiia Nauk SSSR, Izvestiia, Ser. Geofizicheskaia*, No. 6:903–905, June **1960.** 2 tables, 3 refs., 8 eqs. **DWB, DLC**—The assumption that AgI smoke dissipates as a result of mixing is examined by investigating experimentally the dissipation of AgI smoke in a closed cylindrical chamber. The characteristics of the vessel, the experimental procedure and the results are presented. The derivation of an equation for $D$-coefficient of turbulent diffusion is carried out. The formula for $D$ obtained is $D=\frac{R^2}{(\zeta_1^{(0)})^2 T \lg e}\lg\left[\frac{V_1(\zeta_1^{(0)})^2+1.0y\cdot RS(\zeta_1^{(0)})^2+2RS}{2RS}\right]$. The value of $D$ for AgI, namely $1.1\times10^{-2}$ am²/sec is three orders of magnitude greater than Brownian diffusion and ten orders of magnitude less than the diffusion of aqueous fog. *Subject Heading:* **1. Silver iodide diffusion.**—*I.L.D.*

**11M–1015** 551.509.6:061.3(755)

**Academy report stresses need for scientific experimentation in quest of weather control.** *Science*, Wash., D. C., 131(3396):290, Jan. 29, **1960. DLC**—Brief summary of the Skyline Conference on the Design and Conduct of Experiments in Weather Modification, Shenandoah National Park, May 1–3, 1959, sponsored by the National Academy of Sciences, National Research Council, with the support of the National Science Foundation. (For abstract on the official report, *see* 11M–954.) *Subject Heading:* **1. Weather modification conferences.**

**11M–1016** 551.521.1:620.91 551.574.1:551.509.617

**Power from sun, rain on order.** *France Actuelle*, Wash., D. C., 9(14):1–3, July 15, **1960.** 6 photos. **DWB**—Two French projects are described. One of them is concerned with storing up solar energy and distributing it as power. As part of this project, at Mount Louis near Perpignan, the National Center for Scientific Research has been in operation since 1952. Ways and means are being devised to extend the energy produced to practical uses such as the heating of buildings. The other project now in construction near the village of Campistrons on the Lannemezan Plateau facing the French side of Pyrenees, is an Institute for Atmospheric Research. Several pictures show the activities relating to the two projects. *Subject Headings:* **1. Solar energy utilization 2. Cloud physics research 3. Artificial precipitation.**—*I.S.*

## SUPPLEMENTARY MATERIAL

(This section contains unannotated references to articles or papers dealing with general aspects of weather modification in a routine manner, or containing information on details of minor scientific or historical interest, or repeating information given more thoroughly in other papers.)

### 1892

**11M–1017**

U. S. Congress. Senate, **Report of the agent of the Department of Agriculture for making experiments in the production of rainfall.** *Senate Executive Document*, Vol. 5, No. 45, 52nd Congress, 1st Session, **1892.**

**11M–1018**

**The Texas rainmaking experiments.** *Scientific American*, New York, 2. s., 66(1):5–6, Jan. 2, **1892.** 4 figs. **DLC**—Account of GEN. DYRENFORTH'S experiments.

### 1900–1910

**11M–1019**

Abbe, Cleveland, **The weather maker.** *Monthly Weather Review*, Wash., D. C., 28(1):23–24, Jan. **1900. DWB.** Quotation from a book by E. Gerard, **The land beyond the forest**, N. Y., **1888.**

11M–1020
**An African rainmaker.** *Symons's Meteorological Magazine*, London, 37:122–124, **1903. DLC.**

11M–1021
**"Rain-making" among the North American Indians.** *Scottish Geographical Magazine*, Edinburgh, 21:46, **1906. DLC.**

11M–1022
**Mathematics and physics at the British association.** *Nature*, London, 84:513–517, Oct. 20, **1910. DLC.** Abstract of meteorological papers, including a discussion of rain-making.

## 1911–1920

11M–1023
Watt, Andrew, **Big-gun firing and rainfall.** *Scottish Meteorological Society, Journal*, Edinburgh, 3 ser. 17(32):27–29, **1915. DWB.**

11M–1024
**Shooting for rain.** *Tycos*, Rochester, N. Y., 6:16, April **1916. DLC.**

11M–1025
Angot, Alfred, **Le canon et la pluie.** [Gunfire and rainfall.] *Academie d'Agriculture, Paris Comptes Rendus*, **1917.** paging not given. Transl. by E. L. Hawke into English, with title, **Rainfall and Gunfire,** in *Nature*, London, 99:467–468, Aug. 9, **1917. DLC.** Reprinted in *Monthly Weather Review*, Wash., D. C., 45:450–451, Sept. **1917. DWB.**

11M–1026
Brodie, Frederick J., **Gunfire and rainfall.** *Nature*, London, 100:121–126, Jan. 10, 1918. **Comments,** *Ibid.*, p. 371. **DLC.** Reprinted in *Tycos*, Rochester, N. Y. 8:21——, Oct. **1918.** UNCHECKED—Author finds a remarkable excess of rainfall in eastern England during the European war.

11M–1027
Mill, Hugh Robert, **Gunfire in France, rainfall in England.** *Symons's Meteorological Magazine*, London, 53:2–5, **1918. DLC.**

11M–1028
Ward, Robert De C. and Mill, H. R., **The effects of gunfire on the rainfall of the British Isles.** *Monthly Weather Review*, Wash., D. C., 47(3):166, March **1919. DLC.** Reprint of abstract by H. R. Mill in *Geographical Review*, N. Y., Jan., **1919.** p. 51. **DWB.**

11M–1029
Drummond, W. I., **Plow does not affect rainfall.** *International Farm Congress, Yearbook*, pub. Kansas City, **1920.** p. 169–170. **DA.**

## 1921–1930

11M–1030
Patterson, John, **Rainmakers and rain.** *Royal Astronomical Society of Canada, Journal*, 15:194–203, May–June, **1921. DLC.**

11M–1031
Quayle, E. T., **Possibilities of modifying climate by human agency, with special application to southeastern Australia.** *Royal Society of Victoria, Melbourne, Proceedings*, n.s., 23:115–132, **1921. DWB.**

11M–1032
**$4,000 an inch for rain.** *Tycos*, Rochester, N. Y., 11:19, April **1921. DLC.** Reprinted from *Detroit Free Press.*

11M–1033
Quayle, E. T., **Local rain producing influences under human control in South Australia.** *Royal Society of Victoria, Melbourne, Proceedings*, n.s. 34:89–104, **1922.** map. **DWB.**

11M–1034
Sloane, T. O'Conor, **Can we make rain?** *Tycos*, Rochester, N. Y., 12:7–9, Jan., **1922.** **DLC.** Reprint from *Science and Invention*, N. Y.

11M–1035
**Rain and rain makers.** *Tycos*, Rochester, N. Y., 12:11, April **1922.** **DLC.**

11M–1036
Humphreys, William J., **Dusting the clouds for rain.** *American Meteorological Society, Bulletin*, 4:87–88, **1923.** **DWB**—Early suggestions for use of dust, electrified sand, etc., to cause precipitation.

11M–1037
**Rain-making not feasible.** *Tycos*, Rochester, N. Y. 13(3):19–20, 37, July **1923.** 2 figs. **DLC.** Reprinted from the January 13, 1923 issue of "*The Target*" a paper for boys, Cincinnati, Ohio.

11M–1038
Talman, Charles Fitzhugh, **Can we control the weather?** *Tycos*, Rochester, N. Y., 14(1):23–25, Jan. **1924.** 4 figs. **DLC.** Reprint from *The Outlook*, N. Y.

11M–1039
Dacy, George H., **Science seeks to hatch artificial weather.** *Tycos*, Rochester, N. Y., 20:49–52, April **1930.** photos **DLC.**

## 1931–1936

11M–1040
**Artificial rainfall failure.** *Tycos*, Rochester, N. Y., 21:36, Jan. **1931.** **DLC.**

11M–1041
**Chinese rain-making experiments fail.** *Tycos*, Rochester, N. Y., 21:118, July **1931.** **DLC.**

11M–1042
**Rain-making by magic.** *Tycos*, Rochester, N. Y., 22:117, July **1932.** **DLC.**

11M–1043
Wertheimer, Eduard, **Über den natürlichen Ablauf der atmosphärischen Vorgänge und die Möglichkeit einer künstlichen Beeinflussung.** [On the natural course of atmospheric processes and the feasibility of artificial influence.] Braunschweig, **1933.** 16 p. Eqs.

11M–1044
**Rain-making.** *Tycos*, Rochester, N. Y., 23:77, April **1933.** **DLC.**

11M–1045
Stone, Robert G., **Controlled weather; fog dissipation and rainmaking.** *American Meteorological Society, Bulletin*, 15:205–206, Aug./Sept. **1934.** **DWB.**

11M–1046
**Suggestions for making rain flood weather bureau during drought.** *Tycos*, Rochester, N. Y., 24(3/4):97–98, Oct. **1934.** **DLC.** [Abstract of article in *Pathfinder*, Wash., D. C.]

11M–1047
Stone, Robert G., **Quayle on modifications of climate in Australia, [influence on rainfall].** *American Meteorological Society, Bulletin*, 16:148–150, May **1935.** **DWB.**

11M–1048
Frazer, James George, **Aftermath; a supplement to The golden bough.** London, **1936.** 494p.—Contains much material on superstitions, rain-making, etc. **DLC.**

11M–1049
**Rain making.** *Tycos*, Rochester, N. Y., 26:124–125, **1936.** **DLC.**

## 1947

11M–1050
Brownell, Frederick G., **How will you have your weather?** *American Magazine*, Springfield, Ohio, 143(4):44–45, 100–102, April **1947.** map. **DLC.**

11M–1051
Tannehill, Ivan Ray, **Pushbutton rain?** *Science Digest*, Chicago, 21(6):12–14, June 194
**DLC.** Condensed from his book: **Drought; its causes and effects.** Princeton University Pres
**1947.** Ch. 17, p. 176–186.

11M–1052
**How to make it rain.** *Readers Digest*, Pleasantville, N. Y., 51:8–10, Nov. **1947. DLC.**

11M–1053
**Junior's popgun makes snow fall.** *Science Digest*, Chicago, 21(6):88, June **1947. DLC.**

11M–1054
**Nick the rainmaker.** *Life*, Chicago, 23:53–56, 58, Sept. **1947. DLC.**

11M–1055
France. Météorologie Nationale, **La pluie artificielle et ses possibilités.** [Artificial rain ar
its possibilities.] From its *Notes de la Direction*, Nov. **1947. DWB.**

11M–1056
**Rainmaker.** *Newsweek*, N. Y., 30:64, Aug. 4, **1947. DLC.**

11M–1057
**Rainmaker in Peru.** *Time*, Chicago, 50(24):41, Dec. 15, **1947. DLC.**

11M–1058
**Rain makers.** *Time*, Chicago, 50(9):15, Sept. 1, **1947. DLC.**

11M–1059
**Rain making tests.** *N. Y. Times*, Editorial, Sept. 14, **1947. DLC**—Vincent J. Schaefer's dire
tions for cloud seeding briefly described, including size and amount of dry ice particles, air clou
conditions, etc. Mention of use of methods for dispersing hurricanes.

11M–1060
**Whose rain?** *Time*, Chicago, 50(25):44, Dec. 22, **1947. DLC.**

## 1948

11M–1061
Corey, Herbert, **Don't order rain à la carte. You'll be smart to invite a lawyer to your "shower**
*Nation's Business*, 36(3):78–86, March **1948. DLC.**

11M–1062
Georgii, Walter, **Artificial precipitation and its importance for the Argentine economy.** *A*
*genlina. Servicio Meteorológico Nacional, Informe*, No. 7280, Oct. **1948. DWB.**

11M–1063
Goldston, E., **Legal entanglements for the rain-makers.** *Harvard Law School Record*, Marc
April, **1948. DLC.**

11M–1064
Pettit, K. G. and Orr, J. L., **Rainmaking and the law.** *Canadian Aviation*, 21(9):19, Sept. **194**
**DLC.**

11M–1065
**Hard to control weather.** *Science News Letter*, Wash., D. C., 53(5):78, Jan. 31, **1948. DLC**

11M–1066
**Rain by contract; modern rainmaker to wring water from San Diego's clouds.** *Business We*
p. 36, Aug. 28, **1948. DLC.**

11M–1067
**Rain-maker proposes eliminating lightning.** *Science News Letter*, Wash., D. C., 54(21):32
Nov. 20, **1948. DLC.**

11M–1068
**Rain-making with fire.** *Science News Letter*, Wash., D. C., 54(19):301–302, Nov. 6, 1948. DLC.

11M–1069
**Weather or not,** *Time*, Chicago, 52(23):50, Dec. 6, 1948. DLC.

## 1949

11M–1070
**Fire starts rain, rain puts out fire.** *Science Digest*, 25(1):37, Jan. 1949. DLC.

11M–1071
Landing Aids Experiment Station, Arcata, Calif., **LAES Thermal fog dispersal manual.** LAES, Arcata, Calif., 1949. UNCHECKED.

11M–1072
**Wringing out the clouds.** *Time*, Chicago, 53(6):67, Feb. 7, 1949. fig. DLC.

## 1950

11M–1073
Abrioux, —, **Nuages et pluie artificiels.** [Artificial clouds and rain.] *Casablanca. Chambre d'Agriculture, Bulletin*, 21(236):17–21, Dec. 1950. DA (24C26)

11M–1074
Barnes, C. S., **Precipitation control.** *Arizona Cattlelog*, 5(12):60–61, Aug. 1950. DA (43.8Ar42)

11M–1075
**Better rainmaking.** *Time*, Chicago, 55(6):42–43, Feb. 6, 1950. DLC.

11M–1076
Bona, T., **Lotta antigrandine.** [Hail control.] *Il Seme*, 3(7,8):161–164, 175–176, July, Aug. 1951. DA (16Se5)

11M–1077
Burgos, J. J. and De Fina, A. L., **La lluvia artificial.** [Artificial rain.] *Tegucigalpa, Honduras. Camera de Comercio e Industrias, Boletín*, 4(42):15–19, May 1950. DA (287T23). Also in: *Rosario, Argentina, Bolsa de Comercio, Revista*, 38(932):3–4, Nov. 15, 1950. DA (6M764)

11M–1078
Fleming, Roscoe, **Are rainmakers wrecking our weather?** *Science Digest*, 28(10):24–27, Oct. 1950. DLC.

11M–1079
Fleming, Roscoe, **Push-button weather.** *Crops and Soils*, Nov. 1950, p. 10–13. DA.

11M–1080
Mann, M., **Can we make it rain?** *Popular Science*, Boston, 156:130–135, April 1950. DLC.

11M–1081
Perez Malla, J., **Defensa contra el granizo.** [Hail control.] *Barcelona. Camera Oficial Sindical Agraria, Boletín*, 5(2):31–38, Feb. 1950. DA (15C14)

11M–1082
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